

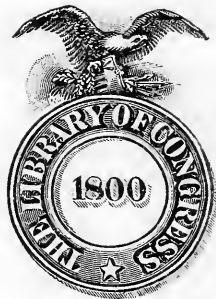
TA

180

W22

SPECIFICATIONS AND CONTRACTS

WADDELL — WAIT



Class TA 180

Book W 22

Copyright N^o

COPYRIGHT DEPOSIT.

NET BOOK NOTICE

It is intended that this book be sold to the public at the advertised price, and is supplied to the trade on terms that will not allow of discount

The Engineering News Book Dept.

SPECIFICATIONS AND CONTRACTS

A SERIES OF LECTURES DELIVERED

BY

J. A. L. WADDELL, C.E., D.Sc., LL.D.,

Author of "De Pontibus," Etc.

INCLUDING EXAMPLES FOR PRACTICE IN
SPECIFICATION AND CONTRACT
WRITING, TOGETHER WITH

NOTES ON THE LAW OF CONTRACTS

By JOHN C. WAIT, M.C.E., LL.B.,

Author of "Engineering and Architectural Jurisprudence," Etc.

2
10
3
3
10 10

NEW YORK

THE ENGINEERING NEWS PUBLISHING COMPANY

1908

TA 180
W22

LIBRARY of CONGRESS
Two Copies Received
DEC 24 1907
Copyright Entry
Dec 5 1907
CLASS 4 XAC. NO.
193 6 14
COPY B.

COPYRIGHT, 1907,
BY
THE ENGINEERING NEWS PUBLISHING CO.

21

8-98.3

PUBLISHER'S PREFACE.

Soon after Dr. Waddell's lecture on "Engineering Contracts" appeared in *The Polytechnic* a large portion of it was copied by *Engineering News*, and at the same time one of the editorial staff of the latter paper wrote him offering to bring out the lecture in pamphlet or book form. Dr. Waddell replied that he had already made arrangements for publishing the lecture in pamphlet form for complimentary distribution; but suggested that a book containing not only the lecture referred to, but also his previous one on "Specifications," supplemented by data for numerous examples for specification, and contract writing by students, and supplemented perhaps also by notes by his friend, Mr. John Cassan Wait, the well-known attorney and author, might prove useful in engineering schools.

In view of Dr. Waddell's peculiar and characteristic method of treating both subjects, in that he deals with the theory or science of preparing these technical documents rather than by following the ordinary method of making numerous and copious quotations from similar documents actually prepared and used, the editors of *Engineering News* adopted immediately his suggestion and arranged with both Dr. Waddell and Mr. Wait for the preparation of the necessary manuscript.

The publishers believe that this little book, if generally used as a text-book in engineering schools, and if each student thereof is required to prepare by its means a complete specification and an exhaustive contract based on the "Examples" given, would do more than any other text-book or combination of text-books to perfect young engineers in the writing of technical documents.

Dr. Waddell stipulated that the price of the book should be kept as low as possible, so as to make its purchase no hardship for the students; and this has been done.

It is sincerely hoped by all concerned that the work will effectively accomplish the sole object of its writers and publishers—viz., the advancement of the engineering profession in one of its most important lines.

THE ENGINEERING NEWS PUBLISHING COMPANY.

220 Broadway, New York.

December 1, 1907.



CONTENTS.

Specifications	1
Examples for Practice in Specification Writing	48
Engineering Contracts	60
Examples for Practice in Contract Writing	110
Notes on the Law of Contracts	130
Index	169

Specifications.

A Lecture Delivered to the Senior Class of the Rensselaer Polytechnic Institute on April 30, 1903.

Thus far, in addressing you, young gentlemen, I flatter myself Introduction that I have interested you and held your attention fairly well; but now I am going to risk losing the prestige that I think I have gained among you, by giving you a long, tedious talk on the dryest of all dry, technical subjects—specifications.

Dry, however, as the subject may be, there is no other of greater importance in engineering practice; hence I feel that I would not be doing either my duty by you or justice to myself were I to spare you the infliction of this last lecture, merely for the sake of trying to leave on your minds the impression that I am an interesting speaker. It will therefore be necessary for you to take your medicine philosophically, and I am going to ask you to give me your closest attention and to endeavor to interest yourselves in all that I say, notwithstanding its extreme dryness.

The substance of this discourse was blocked out a month ago by Mr. Ash, one of the assistant engineers of my firm, and by myself working jointly; it was then partly written and delivered by him to the engineering students of the Missouri State University. Since then I have revised and enlarged the lecture considerably for your special benefit.

Between the individual or corporation desiring the work done Status of Engineer and the contractor who performs it, stands the engineer who has designed it and who usually superintends its execution. He is in the employ of the persons promoting the enterprise, and it devolves upon him to make sure that those who retain him receive an honest and fair return for their money. While it is true that he is employed by only one of the parties to the contract, he should not be partisan, but should strive to see that fairness to both is secured. The engineer should not be an enemy to the contractor, but should work in harmony with him, and should do all he can to further the rapid and harmonious completion of the work, being careful, of

course, to see that nothing is done which will in any way result in an inferior construction. As the engineer's decisions are final (unless it can be shown that actual fraud exists),¹ it behooves him to be careful that no injustice is done to any one.

In order that the contractor may understand the scope of the work to be performed and the details of its construction, a written description and plans more or less complete, defining the methods of construction, material, etc., to be used, are prepared by the engineer for the approval of the company having the work done and for the guidance of the contractor. These written documents are the specifications, and together with the contract, of which they form a part,² they fix definitely the relations that shall subsist between the company or corporation and the contractor.

To build a structure, no matter how simple, there must be a plan, if it is to be constructed intelligently and efficiently. As the size and importance of the structure increase, the plan grows more and more complex, and hence the greater necessity for putting it in some fixed and definite form which shall convey the exact idea existing in the mind of the engineer. To secure the proper execution of a work of any magnitude, specifications are absolutely necessary, and they should be prepared with great care and exactness. For convenience of reference and for clearness, they are usually divided into clauses, which may be classed as general and specific. General clauses refer to the business relations that shall exist between the parties to the contract. In them is found the general description of the work as a whole without any particular reference to details. Times and methods of making payments, adherence to specifications, inspection, and other analogous headings make up their subject matter. They should be comprehensive in their scope, and should not contradict one another. It is well to avoid a double description of any particular thing. Contradictory clauses are sure to be a stumbling block that will create friction and cause delay. At first glance one would say that such clauses are easily eliminated, but care is necessary to accomplish this. For instance, a certain result may be desired in the substructure of a bridge that will not fit in with the kind of superstructure wanted.³

Specific clauses have to do with the details of construction and the description of particular features of design. They embody the

¹ When it is expressly so provided, as is usually the case.

² They should be declared to be so.

³ These general conditions, describing the general relations of the parties, their duties, and general obligations are best embodied in the contract.

Specifications De-
fined

Plans, Utility of

Specifications, Prep-
aration

special ideas that the engineer wishes to incorporate in the work, and they should be just as minute in detail as is requisite to set forth the exact plan desired. Detailed drawings may be necessary to indicate clearly just what is to be done, and these drawings either should be prepared before the specifications are written, or at least should be sufficiently matured in the mind of the engineer to enable him to write his specifications in accordance with them. It must be remembered that the specifications and plans constitute a guide-book for the contractor and for the resident engineer. They should tell what must be done, but should not necessarily state just how it should be done. Specifications should look to the accomplishment of an end rather than to the means of its attainment. Of course, there are exceptions to this, as when the engineer believes that for the best results certain work must be performed in some particular way, in which case it is necessary to incorporate the method in the specifications. It must be remembered that under these circumstances the contractor cannot be held responsible for the mistakes of the engineer. When an engineer specifies that a thing shall be done in a certain way, he must assume the responsibility of the outcome, because the contractor is not free to adopt the method he thinks best suited to the case in hand.¹ For this reason specifications should leave the method, as far as can be done consistently, to the contractor, and instead should dwell upon the end to be attained. A good contractor who is active and progressive may frequently wish to introduce methods of construction better than those conceived by the engineer, and it were a poor set of specifications which would prevent his doing so. A specification can readily be very strict concerning the finished work and at the same time very liberal as to the methods to be employed in its accomplishment.

It frequently happens that specifications are written without any accompanying plans at all. In such cases it is usual to require bidders to submit with their tenders plans more or less detailed of what they propose to do. In this way the engineer may make a choice from various plans presented and thus obtain what he considers the best of a number of ideas. Specifications of this kind will have, of course, very little or nothing at all to do with the details involved, but will be concerned almost entirely with the final desired outcome. In other words, such a specification will consist very largely of general clauses, those of a specific nature being either

Detail Drawings

Specifications, Purpose

Guaranty of Results

Plans Prepared by Contractor

Specifications of Results

¹ The engineer may not specify in detail and then exact a warranty as to results. The law will not imply a warranty.

entirely eliminated or reduced to a minimum. This method of letting contracts without any accompanying plans is by no means to be commended.¹ A good engineer does not want other people to tell him what to use or what to do. If he is thorough and well posted in his profession, he is not going to let his own ideas be superseded by those of a contractor who furnishes plans with his bid. In such a case the engineer becomes only an inspector, who simply passes upon the work and determines whether or not it fulfils requirements, when perhaps much of the work is entirely at variance with his own ideas. It is reasonable to suppose that an engineer who devotes his entire time to designing structures of a particular kind (and no one man will attempt to cover the entire field), is more capable of arriving at the best design for a given case than a contractor who is engaged in work of a varied nature, and who perhaps has given little or no thought to the designing of the particular kind of structure upon which he desires to tender. It is undoubtedly a fact that the best results are accomplished when the plans and specifications are prepared by a competent engineer, and when the bidder is governed by their requirements.²

Specialists

Good Specifications

Specifications Con-
clusive

Let us consider some of the salient features of good specifications. Primarily, they should give a clear and concise description of the work, first when considered as a whole, and then in detail, no part being slighted in this description. It will not answer for the engineer to suppose that the contractor will do things as a matter of course, but he must produce a specification that will *insure* their being done. A contractor, if he be thoughtful and careful, will pay close attention to every detail set forth in the specifications, and he should make his bid, expecting to fulfil just the requirements enumerated in them, no more and no less. If he be wise, he will not bid with the expectation of having them changed to conform to his convenience or his notions of what is best. The engineer is supposed to have stated in his specifications just what he wants, and no prudent contractor will tender, expecting his own ideas to prevail. If, then, upon the engineer devolves the responsibility of determining the work to be done, it will be readily seen that it behooves him to cover the entire ground in his specifications. He should give special attention to the points he intends to require absolutely without

¹ It may be prohibited by statutes, charters, and ordinances which require a standard of comparison and public competition.

² Such a practice is sometimes adopted to meet statutes requiring public competition, where the structure or machine is the subject of a monopoly—as of letters patent.

alteration and should leave no possibility for doubt in the mind of the contractor as to what will be expected concerning them. He should be careful to set forth clearly the units of measure to be employed and what is to be considered a part of the finished work, as distinguished from what is merely accessory.¹ If extra work is to be performed, the amount of which it is impossible to determine in advance, the greatest care should be exercised in defining clearly just what shall constitute such extra work and in fixing the compensation for it. Failure to do this is frequently a source of trouble and annoyance that might be avoided by careful wording.

Extra Work Defined

Specifications should be designed to secure the best results consistent with what is considered good practice. It is possible to make requirements of such a nature that to fulfil them would mean an enormous outlay of money not at all proportionate to the result. Such clauses in a specification make a bidder uneasy and will cause him to add to his bid a sufficient amount in addition to his profit to insure him against loss. A bidder should make his tender expecting to comply with the conditions of the specifications, and expecting that his fellow bidders will do the same, and a clause that involves an unduly strict condition is liable to cause him either to tender high or to bid hoping that its fulfilment to the letter will not be demanded. In nine cases out of ten such a clause will be dearly paid for.

When Results are Wanted

Absolute perfection is not to be expected, but the very best that the most approved practice will afford should govern the requirements. An engineer must lose prestige if he specify things which cannot consistently be done, and by inserting such requirements he works injury to all parties concerned. In the matter of materials to be used he must be governed by the locality and by what the market has to offer. He may be unable to get just what he would like; therefore he must use the best that can be obtained. These remarks do not imply that the engineer should be satisfied with any makeshift that is offered. He can rest assured that he will not receive anything *better* than he demands, and he is fortunate if he succeeds in getting everything as good as he specifies. As he is a large factor in determining what shall be considered good practice, he should not be content to put up with shoddy stuff when better can be obtained. As in all business relations, moderation with firmness should govern.

Advantages of Locality and Market

¹ False works should not usually be made the subject of public letting, as for public improvements.

Language of Specifications

Again, specifications should be written in simple, plain language without any attempt at rhetoric. All verbs should be complete, and no words should be omitted on the assumption that they are understood. Of course, the law will interpret a contract or a specification in accordance with what the court decides is its spirit,¹ but an engineer should not rely upon this to guard against omission. If the specifications are properly prepared, there should be no occasion for appealing to the courts to decide what is or is not the spirit intended. While such documents should be comprehensive, they should not be verbose, and, above all things, they must not be ambiguous. Short sentences and simple words are preferred. Punctuation and grammar, while usually and erroneously considered of minor importance in an engineer's practice, certainly play an important part in this particular kind of literature. The meaning of a sentence can easily be distorted, or even entirely changed, by the placing of a comma. Do not fear to repeat the same words or phrases over and over again in your specifications, if you find they best convey the idea you have in mind. This may involve occasionally some lack of euphony, but that can very readily be dispensed with in writings of such a prosaic nature.

Several Contractors

Should more than one contractor be employed upon a piece of work, great care must be exercised to define clearly the duties of each. Just where one is to finish and the other is to begin should be set forth so as to leave no possibility of doubt. When practicable in such cases, separate and distinct specifications for the different parts of the work should be prepared. Care should be taken that the same thing is not required of both contractors, and that one contractor is to leave his part of the work in such shape as to involve no hardship or inconvenience for the one who is to follow. As an illustration of cases of this kind, in bridge work it frequently happens that one contractor will do the substructure work while another will build the superstructure. It is then necessary to specify who is to set the anchor bolts and anchorages.

Favoritism

The engineer must be careful about putting anything into his specifications that has even the appearance of favoritism. He must be constantly on his guard to avoid this, for his position is such that his reputation is liable to suffer if he deviate in the least from strict fairness to all. It is bad policy, generally speaking, to require a particular brand of material or the product of a given firm without stating that other material will be accepted, if, upon testing,

¹ The intention of the parties.

it be found of equal quality. When a given brand is well-known and has an established reputation, it is sometimes proper to specify that it shall be used to the exclusion of other makes, but usually it is best to set a standard which is commensurate with the best product to be had, and then to accept any brand which meets the requirements.¹ An exception to this rule is permissible when specifying paint for metal-work, because, unless the particular brand be stated, the contractor is liable to give endless trouble by offering for test inferior brands, and the result is very likely to be the adoption of a paint that is not really satisfactory. Unscrupulous parties are ever ready to give the engineer a bonus in case he use their product, and that engineer is fortunate who has an extensive practice and is yet entirely free from all charges of peccability. Where one man's product is rejected and another's used, there is a great temptation on the part of the disappointed person to question the fairness of the proceeding. An engineer once guilty of crookedness is badly handicapped, and justly so, for no man wishes to entrust the expenditure of his capital to one who is not absolutely above suspicion.²

Commercialism

Engineer's Preparation

To insure all the conditions that have been enumerated, it is evident that the engineer must familiarize himself with every detail of the work in hand. If he does not understand it himself, it is certain that he will not succeed in getting a clear idea of what he wants into the mind of another. Even when the scheme is perfected in the engineer's mind, it is difficult sometimes to make it plain to the contractor.

Changed Conditions

It will not do to jump at hasty conclusions, for very often one finds that an idea, which at first seemed to be just what was wanted, proves utterly untenable when considered in connection with other ideas that must be incorporated in order to produce a finished construction. No idea for a specification has any value until it has been fitted into the proposed structure, and is found to harmonize with all the other requirements.

Alterations

It is usual and proper in specifications to insert a clause allowing the engineer the privilege of changing them or the plans as the work progresses, but it is desirable for all concerned that the number of these changes be reduced to a minimum. A perfect set of specifications would render such a clause useless, but since we

¹ If materials are specified by name and not by tests or results, the contractor can be held only to deliver the brand or kind named.

² Commercialism in engineering practice is pretty certain to arouse suspicion.

have not yet attained to perfection, we must have some means of recourse, bearing in mind, however, that the more such a clause as the one referred to is brought into use, the farther we are from the ideal.¹

Precision

The question of precision is one which should never be lost from sight. If the engineer is to maintain his prestige, he must be precise. It will not do for him to say "about this" or "about that," for the "about" is very liable to assume proportions which were never dreamed of when the term was used. Of course, there are times when it is neither necessary nor desirable to be absolutely exact in requirements, but generally speaking the word 'about' has very little place in a set of specifications. What is put into them is placed there with the idea that it is to be operative and binding in the construction of the work, and it is the duty of the engineer first of all to impose no impossible or unwise conditions,² and next to see that what he has required is fulfilled to the letter.

Prior Negotiations
not Pertinent

The specifications form a part of the contract,³ and when the latter is signed, the contractor agrees to all the conditions they set forth. It is proper to assume that he has read the specifications and is familiar with their requirements, and that he signs the contract and makes his bond with the full knowledge of what is before him.⁴ A specification should never hide from the contractor difficulties that are likely to be encountered. On the contrary, when such difficulties are known to the engineer, they should be specially called to the contractor's notice, so that he may bid more intelligently. His attention, however, should not be drawn to them in such a way as to frighten him and to cause him to make a bid abnormally high, but the facts as they exist and are known to the engineer should be stated. As in all relations in life, straightforward, fair-and-square dealing is by far the best policy. No railroad company or other corporation is benefitted by letting a contract for a sum below the actual cost, plus a reasonable percentage for profit, since the delays incident to the contractor's failure, and the litigation that is likely to arise will more than counterbalance the supposed saving. No contractor who is losing money is going to make the same exertion to accomplish his task properly as one who realizes that he is earning a fair profit.

Concealment of
Facts

¹ Powers of an engineer to make changes should be limited to the details of construction and of materials.

² And as few in the alternative as possible.

³ They should be made so by the text.

⁴ He may be held to the terms, if he has not read them.

In spite of every precaution that may be taken, it is almost impossible to avoid mistakes entirely. A given proposition may appear to the engineer in his office, before work has commenced, very different from what he finds it in the field after the construction has begun. When an engineer discovers that he has made a mistake, he should not hesitate to acknowledge it, and to set about, as best he may, to correct the error. He should lose no opportunity to check against errors, and should be thankful when they are discovered in time to prevent harm. To reduce mistakes to a minimum, the engineer must be thoroughly conversant with all contingencies likely to arise in the execution of the work. He should familiarize himself with the appliances ordinarily employed, and should so design his work that their use will not be prohibited. In writing his specifications and in making the plans, he should have a clear and complete mental picture of just what he is striving to attain. It must be remembered that if the specifications are lived up to, they will entirely determine the result, and that it is the plans and specifications wherein the creative power of the engineer asserts itself.

Finally, when all is said and done, common sense must govern the interpretation and execution of any set of specifications. All should have but one object in view—the production of a structure that will be a credit to every one concerned.

Up to this point I have been dealing mainly with generalities, but now I shall go more into detail, taking up first general clauses and later specific ones. These general clauses will be ample for all engineering specifications, and can therefore be used for all kinds of engineering construction; but it would be impossible to cover the entire ground of specific clauses, consequently I shall simply quote some characteristic ones from specifications for different kinds of construction, and point out some of their peculiar features and *raisons d'être*. Naturally, in offering you examples of specifications, I shall utilize some of those prepared by my firm, and shall trust that you will pardon me for so doing, because I am responsible for them, while, of course, I could not be accountable for the correctness of everything in case I were to quote from the specifications of other engineers. In order to present to you a wide range of specific clauses, I shall make extracts from specifications for bridge superstructures, bridge substructures, steel lighthouses, an ocean pier, and a steel pipe-line. From a study of these you will be aided materially in the preparation of specific clauses for any class of construction on which you may be engaged.

Engineer's Mistakes

Ultimate Object

General and Special Provisions

Subjects for Study

Ground Covered by
Thorough Bridge
Specifications

But first, in order to give you an idea of the ground which a thorough set of specifications must cover, let me read to you the alphabetical list of headings in our "Specifications for the Rebuilding of Ten Bridges on the International and Great Northern Railroad":

Titles

Accompanying Drawings; Adherence to Specifications; Alteration of Plans; Anchor-Bolts; Annealing; Approximate Quantities of Materials, etc.; Back Filling; Bank Protection; Bending Tests; Bond; Built Members; Caissons Sunk by Pneumatic Process; Cast Iron; Cast Steel; Cement; Closing Thoroughfares; Cofferdam Work; Company; Composition of Rolled Steel; Concrete; Concrete Piers and Abutments; Construction; Contract; Damages; Defective Work; Depths of Foundations; Directions to Contractor; Drawings; Drifting Tests; Dry Surfaces in Concrete; Elastic Limits; Elongation; Encountering Obstacles; Engineer; Excavation; Extras; Eye-Bars; Falsework; Field Riveting; Filling Column Feet; Final Inspection; Floors; Fracture; General Description; General Provisions on Methods of Testing; Granitoid; Hauling over Company's Lines; Identification; Inspection; Interference with Traffic; Liquidated Damages; Location; Loss of Metal; Metal; *Modus Operandi* of Construction; Name-Plates; Number of Test Pieces; Paint; Painting; Payments; Pile Foundations; Piles; Pin-Holes; Pin Metal; Pins; Position of Piers, Pedestals, and Abutments; Prices of Materials; Punching and Reaming; Reduction of Area; Re-Entrant Corners; Removal of Old Piers; Responsibility for Accidents; Return of Papers; Rivet-Holes; Rivets; Rolled Steel; Rollers; Routing of Materials; Scope of Contract; Sheared Edges; Shipping; Spirit of the Specifications; Steel Cutting Edges; Strictness of Inspection; Tenders; Tensile Strength; Tests of Full-Sized Eye-Bars; Tests of Full-Sized Members or Details; Timber; Time of Completion; Turn-Buckles, Nuts, Threads, and Washers; Turned Bolts; Use of Old Rails; Variation in Weight; Workmanship; Wrought Iron.

Although I have omitted ten headings that simply enumerate the various crossings, the list contains nearly one hundred clauses, only seventeen of which may properly be termed general. The latter I shall now proceed to read and discuss in the order in which they appear in this particular set of specifications.

ADHERENCE TO SPECIFICATIONS.

Specifications to be
Followed

"All the work herein outlined is to be done in strict accordance with the specifications, the accompanying plans, and such instructions as may be given from time to time by the Company's engineers.

Bidders are hereby warned that they will be held strictly to the spirit of these specifications, and that it will be bad policy for any one to bid with the expectation that concessions will be made after the contract is closed, in order that the work may be cheapened; for while the Company's engineers desire to aid the Contractors in every legitimate manner to do their work expeditiously and economically, at the same time they have given these plans and specifications the most thorough consideration, and know exactly what they need in respect both to design and to quality of materials and workmanship. On this account, bidders are respectfully requested not to complicate their tenders by putting in alternative bids based upon proposed changes in either plans or specifications, because such alternative bids will not be considered."

This clause, which is common to all of our specifications, was originated by me some ten years ago, in order to prevent bidders from trying to modify our plans and specifications by offering some of their own for the purpose either of cheapening the work or of giving the bidder an advantage over his competitors. Promoters of enterprises are too prone to listen to the specious arguments of bidders when they contend that they are better posted upon what is needed than are the engineers. Whenever the promoters permit themselves to be influenced by such arguments they are certain to come to grief. Contractors work for their own interests, and it is right that they should do so; but they ought not to claim that their advice is unprejudiced and is offered for the sole purpose of improving the construction; when they do, they are not speaking the truth. For many years I have had to struggle constantly and vigorously against such attempts of bidders and contractors to change my plans and specifications, and on more than one occasion I have had to take the stand that either the promoter must refuse to entertain the bidders' suggestions or that I must resign my position. In one of these instances there were involved some two million dollars' worth of work; and I came within an ace of losing the engineering on it by my absolute refusal to consider the fundamental changes in my plans and specifications that were proposed by the bidders. By adopting the preceding clause and by adhering strictly to its context, I have, after many years, succeeded in preventing any more such attempts to upset my work. Of course, in minor matters when a contractor offers politely any reasonable suggestion tending toward the modification of my requirements, I am always ready to consider it, and I never refuse to accede to such a request, if it be proved

Alterations to be
Avoided

Effect of Changes

that the change is either beneficial or at least not detrimental to the construction.¹

DRAWINGS.

Detail Drawings

"As soon as practicable after the signing of the contract for rebuilding the structures, complete detail drawings will be furnished by the Engineer, and from these the Contractor is to prepare his working drawings, complying carefully therewith, and making no changes without the written consent of the Engineer. The working drawings are to be sent in triplicate for the approval of the Engineer, who will retain two sets and return the third after checking same and marking thereon any changes or corrections desired; after which a corrected set of working drawings shall be sent without delay by the Contractor to the Engineer. The approval of the said working drawings by the Engineer will not relieve the Contractor from the responsibility of any errors thereon.

Drawings to be Verified

The drawings furnished by the Engineer shall be checked carefully by the Contractor before beginning work. Should any errors be discovered, the Engineer's attention shall be called to same, and corrections will be made, after which the Contractor shall be responsible for all errors which may occur or which may have occurred. The Engineer shall have the right to alter as he may see fit the preliminary plans, if further investigation of the conditions affecting the proposed structure so warrant; and he shall be at liberty to make minor changes in all plans during construction without any charge being made for same by the Contractor, unless, in the opinion of the Engineer, the Contractor be really entitled to extra compensation on account of such changes.

Contractor's Details.

The Contractor shall furnish without charge as many sets of working drawings as the Engineer and other officers of the Company may deem necessary for their use during construction or for record.

Engineer's Details

Should the Engineer prepare any working drawings, they shall be checked carefully by the Contractor; and, if any errors be discovered, the Engineer's attention shall be called thereto. After the proper corrections of these are made, the Contractor shall be responsible for all errors which may occur or which may have occurred."²

Responsibility for Errors

It may at first thought appear a little arbitrary to hold the

¹ Material changes often affect the rights and liabilities of the parties, and lead to complications, in case of litigation.

² This would doubtless apply only to errors in working drawings.

Contractor responsible for any errors that there may be in the Engineer's plans, but a little consideration will show that, if there are any such errors, they ought to be discovered before work is started, and that, as the Contractor is to attend to the construction, he ought to make sure in advance that the entire scheme is correct in every particular; who is there, then, so suitable as he to do the checking and to correct the mistakes?¹

It is not a good plan for the Engineer to prepare shop-drawings for metal-work, because no two shops have exactly the same method of making working drawings; those suitable for one manufacturing company would not be acceptable to another. It is therefore much better for the Engineer to draft complete detail plans, then submit them to the Contractor as a guide for the preparation of the shop-drawings.

INSPECTION.

"The inspection and tests of metal will be made promptly on its being rolled or cast, and the quality will be determined before it leaves the rolling-mill or foundry. The inspection of workmanship will be made as the manufacture of the material progresses, and at as early a period as the nature of the work will permit.

Inspection, Facilities for

All facilities for inspection of metal and workmanship shall be furnished by the Contractor; and the Engineer and his inspectors shall have free access to all parts of the plant in which any portion of the metal is being made.

The Contractor shall give the Inspector due notice when any metal is ready for inspection. Any delay on the part of the Inspector shall be reported to the Engineer, but no material will be accepted which has not been passed upon by the authorized representative of the Engineer.

Notice of, and Delay

All other materials than metal used on the work shall be inspected after delivery at site, unless the Contractor shall elect to have any materials inspected elsewhere, in which case the said materials shall be inspected by the Engineer at the places designated by the Contractor; but all expenses connected with such inspection shall be borne by the Contractor, and shall be paid promptly from time to time upon presentation of bills for same."

Field Inspection

The reason for stipulating that all materials excepting metal shall be inspected at site, unless the Contractor elect to have the inspection done elsewhere at his own cost, is that without this

Expense of Inspection

¹ This may be true in steelwork, but it will not hold in all classes of construction work.

restriction there would be no end to the expense to which an Engineer would be put in sending inspectors all over the country to stone quarries, cement manufactories, sand pits, lumber mills, and forests.

FINAL INSPECTION.

Final Inspection

"Before the completed work on each bridge is accepted and paid for in full, the Contractor shall notify the Engineer in writing that it is ready for final inspection. Upon receipt of this notification, the Engineer will arrange to give the entire work on the said bridge a minute and thorough inspection, either in person or through a competent representative who has not been employed regularly on this special work. Any defects or omissions noted during this inspection must be made good by the Contractor, without extra charge, before the work will be accepted and paid for in full."

The reason for specifying that the final inspection shall not be made by the resident engineer is that no man can well check or inspect his own work, because he will be almost certain to overlook any errors or omissions that had previously escaped his notice.

DEFECTIVE WORK.

Defects to be Made Good

"The Contractor, upon being so directed by the Engineer, shall remove, rebuild, or make good, without charge, any work which the said Engineer may consider to be executed defectively. The fact that any defective material in the structure had been accepted previously by the oversight of the Company's Engineers or Inspectors shall not be considered a valid reason for the Contractor's refusing to remove it or to make it good. And until such defective work is removed and made good, the Engineer shall deduct from the partial payments or the final payment, as the case may be, whatever sum for such defective work as may, in his opinion, appear just and equitable."

Inspection and Acceptance

Many contractors object strenuously to the clause which forces them to remove and replace any defective work, claiming that anything which is once passed is accepted finally, and that if it has to be rebuilt, the extra work involved should be paid for by the Company. But if such an arrangement as this were to rule, it would act as an incentive for contractors to attempt to bribe the inspectors, and would leave the Company without recourse from the results of the latter's dishonesty.

DIRECTIONS TO CONTRACTOR.

Foreman in Charge

"In case the Contractor shall not be present upon the work at any time when it may be necessary for the Engineer to give instruc-

tions, the foreman in charge for the time being shall receive and obey any orders that the Engineer may give.

The Contractor shall commence work at such points as the Engineer may direct, and shall conform to his directions as to the order and time in which the different parts of the work shall be done, as well as to the force required to complete the work at the date specified.

Progress

CLOSING THOROUGHFARES.

The Contractor and his employees shall so conduct their operations as not to close any thoroughfare by land or water without the written consent of the proper authorities of such thoroughfare.

Thoroughfares

RESPONSIBILITY FOR ACCIDENTS.

The Contractor shall assume all responsibility for accidents to men, animals, materials, and trains before the acceptance of the structure; and must remove at his own expense all false-work, rubbish, or other débris caused by his operations; and such work shall be included as a part of the work to be performed. The Contractor shall place sufficient and proper guards for the prevention of accidents, and shall put up and maintain at night suitable and sufficient lights.

Accidents

DAMAGES.

The Contractor shall indemnify and save harmless the Company against all claims and demands of all parties whatsoever for damages or compensation for injuries arising from any obstructions erected by the Contractor or his employees, or from any neglect or omission to provide proper lights and signals during the construction of the work.

Indemnity

ALTERATION OF PLANS.

The Engineer shall have the power to vary, extend, increase, or diminish the quantity of the work or to dispense with a portion thereof during its progress without impairing the contract, and no allowance will be made the Contractor except for the work actually done. In case any change involve the execution of work of a class not herein provided for, the Contractor shall perform the same, and shall be paid the actual cost thereof plus the percentage for profit agreed upon in the contract. In this case the Contractor must furnish the Engineer with satisfactory vouchers for all labor and material expended on the work.

Alterations and Compensation

STRICTNESS OF INSPECTION.

Inspection

All materials and workmanship will be inspected thoroughly and carefully, and the Contractor will be held at all times to the spirit of the specifications; but nothing will be done by the Company's engineers or inspectors to give the Contractor needless worry or annoyance, the intent of both specifications and inspection being simply to obtain for the Company work that will be first-class in every particular and a credit to every one connected with its designing and construction."

This clause contains in a nutshell the entire code of ethics which should govern the Engineer in his dealings with the Contractor.

SPIRIT OF THE SPECIFICATIONS.

Intent

"The nature and spirit of these specifications are to provide for the work herein enumerated to be fully completed in every detail for the purpose designed; and it is hereby understood that the Contractor, in accepting the contract, agrees to furnish any and everything necessary for such construction, notwithstanding any omission in the drawings or specifications."

It may seem unfair to bind the Contractor to furnish things not called for in the specifications; but the clause is intended to cover only such things as are absolutely necessary for the work and which were evidently overlooked when the bidding papers were prepared.

PAYMENTS.

Progress Payments

"Payments for work shall be made as follows:¹

On or about the first day of the month the Engineer will estimate the value of the work done and materials furnished; and within twenty-five (25) days thereafter, eighty-five (85) per cent. of the value thus determined, less previous payments, shall be paid to the Contractor in cash. Upon the completion of each bridge involved in the contract, and upon acceptance of same in writing by the Company, the balance due the Contractor for the said bridge shall be paid to the said Contractor in cash.

Liens Discharged

Before, however, the final payment on any bridge is made, the Contractor shall show to the Company satisfactory evidence that all just liens, claims, and demands of his employees, or of parties from whom materials used in the construction of the work may have been purchased or procured, are fully satisfied; and that the materials furnished and work done on the structure are released fully from all such liens, claims, and demands.

¹ These clauses are more frequently made a part of the contract.

If, too, during the progress of the work, it appear that the Contractor's bills for labor and materials are not being paid, the Company shall have the right to withhold from the Contractor's monthly payments a sufficient sum or sums to guarantee itself against all losses from mechanics' and other possible liens, and to apply the said sum or sums to the payment of such debts. Bills to be Paid

Or, if during construction it appear to the Engineer that the Contractor is not making proper progress, the Company shall have the right, after giving the Contractor ten days' notice in writing, to undertake itself, either by administration or by letting a contract to other parties, the completion of the said work which is being thus neglected. Should the Company's work cost less than what the Contractor would have been paid, the difference shall be paid to the Contractor; but on the other hand, should it cost more, the difference shall be charged to the Contractor, and shall be taken out of the reserved fifteen (15) per cent., or out of the bond. Abandonment

Under these circumstances the Company shall have the right to enter upon and take temporary possession of the plant, tools, materials, and supplies of the said Contractor or any part thereof. In case that the percentage of earnings withheld by the Company be insufficient to make good the deficit, the Company shall have the right to reimburse itself by the sale of the Contractor's plant; but otherwise the said plant shall be returned to the Contractor after the completion of the work." Completion by Owner

The number of days that may elapse between the time of preparing the monthly estimates and the date of payment varies generally from ten to thirty, according to the attendant conditions, it being necessary to allow time for the compilation of statistics, mailing of papers, distribution of estimates, and forwarding of checks. Monthly Estimates

The amount retained from each estimate by the Company until the completion of the entire contract is generally ten per cent. and never more than fifteen per cent. Percentage Retained

It is one of the most important duties of the Engineer to make sure that his clients are protected against mechanics' and other liens upon the work, and he will have to be ever on the alert to insure this when dealing with irresponsible or tricky contractors.

The handling of work by administration is generally rather expensive for the Company and burdensome to the Engineer; hence it is to be avoided whenever possible.

EXTRAS.¹

Extras

"No extras will be allowed or paid for unless they be ordered in writing by the Engineer. For extras so allowed the Contractor will be paid the actual cost to him plus ten (10) per cent. for profit. Satisfactory vouchers will be required from the Contractor for all extra labor and materials."

The question of extras is always likely to be a bone of contention between the Contractor and the Engineer; consequently the more fully it is covered in the specifications the better for both parties.

BOND.

Surety

"The successful bidder will be required to give the Company a satisfactory Surety Company Bond, in the sum of dollars, for the faithful performance of the contract and specifications and all the terms and conditions therein contained, and for the prompt payment for all material and labor used in the manufacture and construction of the structures, and to protect and save harmless the Company from all damages to persons or property, caused by the negligence or claim of negligence by the Contractor, his agents, servants, or employees in doing the work, or in connection therewith. Each bidder must state in his tender the name of the Surety Company that he offers for furnishing this bond.

CONTRACT.

Contract

As soon as possible after the award of the contract is made, a contract similar to that outlined on the accompanying form will be presented in duplicate to the successful bidder for his signature, after which both copies will be signed by the Company, and one of them will be given to the said successful bidder.

RETURN OF PAPERS.

Return of Papers

All papers submitted to bidders, excepting only those of the successful bidder, are to be returned to the Consulting Engineers upon demand."

The reason why the unsuccessful bidders are required to return the papers submitted to them for tendering is that several copies of the plans and specifications will be required later for those prosecuting the work, and this return of papers will effect an economy in copying.

Example, a Bridge

Before leaving the subject of general clauses, I shall quote a few found in the contract (of which the specifications form a part).

¹ This is more often made a part of the contract.

The division of the entire list of general clauses between the specifications and the contract is purely arbitrary. My firm has a certain form of contract of its own, which will apply to any and all of our specifications by simply filling in the blank spaces. It is from this form that I am about to quote certain paragraphs in order to complete my list of general clauses that will apply to all engineering specifications.

CARE OF DELIVERED MATERIAL.

"All material paid for by the party of the first part shall be deemed to have been delivered to, and to have become the property of the said first party, but the party of the second part hereby agrees to store it and to become responsible therefor during the continuance of this agreement."

Ownership of Materials

The object of this clause is to make the Contractor responsible for the care and insurance of all materials delivered and partially paid for. Without some such provision the Company would have to stand all losses from flood, fire, and theft before the completion and acceptance of the structure.

EXTENSION OF TIME.

"In case the party of the first part, notwithstanding the failure of the party of the second part to complete its work within the time specified, shall permit the said second party to proceed and continue and complete the same as if such time had not lapsed, such permission shall not be deemed a waiver in any respect, by the first party, of any forfeiture or liability for damages or expense thereby incurred, arising from such non-completion of said work within the time specified, and covered by the "Liquidated Damages" clause of the specifications; but such liability shall continue in full force against the said second party, as if such permission had not been granted."

Time Limit not Waived

Without some such clause as this the Contractor when allowed to exceed his contract time might claim immunity from liquidated damages, and thus render that clause of the specifications null and void.

CHANGE OF PLAN OR OF CONTRACT.

"No change or alteration shall be made in the terms or conditions of this agreement without the consent of both parties hereto in writing; and no claim shall be made or considered for any extra work, unless the same shall be authorized and directed in writing by the Engineer, as herein provided.

Written Order for Extras

EXTRA COMPENSATION.

No Damages for
Delay

In the event of any delay in completing the work embraced in this contract, the party of the second part shall be entitled to no extra compensation on account of such delay; as it is hereby assumed that in submitting its tender it took its chances for the occurrence of such delay."

This is an unusual clause in engineering contracts, having been originated by me some years ago. The usual objection to it is that it is entirely one-sided, which cannot be denied. It is certainly likely to be of great advantage to the Company, as the latter is often tied up by litigation and sometimes from want of sufficient funds to prosecute the construction continuously or as rapidly as desired. Of course, the Engineer in applying this clause must use his judgment and sense of equity to make sure that it does not involve any real hardship for the Contractor. Its main object is to prevent the latter from claiming exemption from all liquidated damages or from demanding extra compensation on account of trifling delays caused either by the Company or by circumstances beyond the Company's control.

SUBCONTRACTING.

Assignment For-
bidden

"The party of the second part hereby agrees that it will not assign or sublet the work covered in this contract, or any portion of it, without the written consent of the party of the first part, but will keep the same within its control.

ARBITRATION OF DISPUTES.

Engineer's Decision

The decision of the Engineer shall control as to the interpretation of drawings and specifications during the execution of the work thereunder; but if either party shall consider itself aggrieved by any decision, it may require the dispute to be finally and conclusively settled by the decision of three arbitrators, the first to be appointed by the party of the first part, the second by the party of the second part, and the third by the two arbitrators thus chosen. By the decision of these three arbitrators, or by that of a majority of them, both parties to this agreement shall be finally bound."

Arbitration

It is seldom that this arbitration clause is resorted to, for the Engineer's decisions are almost invariably just and reasonable. Only once in my entire career has it been put in force on my work, and, as in this instance there was too good an understanding between the promoter of the enterprise and the dealer who furnished the rejected materials, I lost the case.

NOTIFICATION OF IMPENDING SUITS.

"As, according to the terms of the accompanying specifications, Indemnity which form a part of this contract, the party of the second part is to indemnify the party of the first part against all liability or damages on account of accidents occasioned by the omission or negligence of itself, or its agents, or its workmen during the continuance of this agreement, and is to pay all judgments recovered by reason of such accidents in any suit or suits against the party of the first part, including legal costs, court and other expenses; it is hereby agreed that the party of the second part shall be promptly and duly notified in writing by the party of the first part of the bringing of any such suit or suits, and shall be given the option of assuming the sole defense thereof." Litigation

This provision is entirely in the Contractor's favor, but the point involved is one of simple equity; for if he is to pay all damages he certainly ought to be allowed to handle the legal fight in his own way.

And now I shall quote some specific clauses merely to illustrate their general style and character; for it is obvious that it would be impracticable in a lecture like this to attempt to cover all the specific clauses for even one class of construction—much less for all classes. Specific Clauses

The following clauses are taken from the same set of specifications as before:

SCOPE OF CONTRACT.

"The contract will cover the following:

Removal of Old Structures

1st. Removal of old spans, marking properly all the pieces of same, and piling these near the site as per the instructions of the Engineer.

2d. Removal of old piers and portions of old piers, and distributing the removed masonry as rip-rap around the piers of the same bridges from which the said masonry was taken, all in accordance with the instructions of the Engineer.

3d. The furnishing of all materials (excepting old rails) for Old Materials and the rebuilding of the tops of old piers that are to be repaired.

4th. The furnishing of all materials (excepting old rails) for and the building of all new piers and abutments.

5th. The furnishing of all the materials (excepting track rails and their fastenings) for and the building complete of all the new spans required, including the timber floor. New Materials

6th. Providing all materials for and building all falsework to carry the old fixed spans which are to be left in, while the supporting piers are being repaired, and removing the said falsework as soon as the Engineer gives directions for such removal.

7th. Laying of tracks on all new spans and connecting same properly to the approaches."

Let me call your attention to the clearness and conciseness with which the various items in this clause are stated, and caution you when preparing specifications of your own to be just as clear in everything relating to "Scope of Contract," for this is one of the most important clauses of any set of specifications.

HAULING OVER COMPANY'S LINES.

Rights of Way

"There will be no charge for hauling over the Company's lines any of the Contractor's men, materials, or plant."

APPROXIMATE QUANTITIES OF MATERIALS, ETC.

Statement of Quantities

"The following are the approximate quantities of materials, etc., in the ten (10) structures. They will be used in comparing tenders for awarding of contract, but are not to be considered in any way binding upon the Company or upon its Engineers:

Structural steel in new pin-span, erected

and painted 1,313,000 lbs.

Structural steel in new plate girder spans,

erected and painted..... 6,586,000 lbs.

Timber in railway floors..... 400 M. feet, B. M.

Length of single track to be laid..... 4,300 lineal feet.

Old spans to be removed..... 3,311 lineal feet.

Old masonry to be removed..... 1,612 cubic yards.

Mass in caisson and crib of pneumatic pier.. 1,360 cubic yards.

Mass in cribs or bases of all other piers... 2,800 cubic yards.

Concrete in bases of all abutments (no

allowance being made for cost of excava-

tion, coffer-dams, pumping, bailing, etc.). 2,100 cubic yards.

Concrete in shafts of piers and abutments.. 13,200 cubic yards.

Piles in place, below bottoms of cribs..... 16,200 lineal feet.

Length of old spans to be supported on

falsework 473 lineal feet.

Temporary Works

There will be no allowance for excavation or for back filling, as the cost of these items must be covered by the schedule prices for mass of foundations and piles in place.

Neither will there be any allowance made for cost of removing

old wooden trestle, as the Contractor will utilize the same for false-work to support the new girders.

Neither will there be any allowance made for the placing as rip-rap around the piers the masonry stones removed from the existing piers, as this must be covered by the schedule price for the removal of masonry."

Although the quantities given under this heading are generally approximate, it is very important, nevertheless, that they be filled out; because, in the first place, they give bidders a proper conception of the magnitude of the work, and, in the second place, they afford a means of comparing bids on a basis that is perfectly fair to all competitors.

Quantities, Approximate

INTERFERENCE WITH TRAFFIC.

"The Contractor must so conduct all of his operations as not to interfere at all with the passage of the Company's trains; and he must take every precaution against accidents to the said trains caused by his operations. Should any accidents occur by reason of such operations, either directly or indirectly, the Contractor will be held responsible both pecuniarily and morally for the results of such accidents."

Traffic Interference

The importance of this clause to the railroad company cannot be overestimated. Wherever bridges are to be constructed on lines in operation, this clause should under no circumstances whatsoever be omitted.

REMOVAL OF OLD PIERS.

"In taking down existing piers which are not to be rebuilt, small charges of explosives may, with the consent of the Engineer, be used; but none may be employed for removing the tops of piers that are to be rebuilt. In the latter the greatest of care must be taken not to injure any of the masonry that is to be preserved.

Blasting

All masonry that is removed from the old piers and abutments must be disposed of as rip-rap for piers, or otherwise as directed by the Engineer.

METAL.

Unless otherwise specified, all metal shall be medium steel, excepting only that rivets and bolts are to be of soft steel and adjustable members of either soft steel or wrought iron.

Steel and Iron

Except for the washers for floor bolts, cast iron will not be allowed to be used in the superstructure, cast steel being employed wherever important castings are necessary.

ROLLED STEEL.

Rolled Steel

All steel shall be manufactured by either the acid or the basic open-hearth process, and must be uniform in character for each specified kind. Any attempt to substitute Bessemer or any other steel for the open-hearth product will be considered a violation of the contract and a good and sufficient reason for cancelling the same.

All plates shall be rolled from slabs. These slabs shall be made by a separate operation, by rolling an ingot and cutting off the scrap. The original ingot shall have at least twice the cross-sectional area of the slab, and the latter shall be at least six (6) times as thick as the plate.

All finished material coming from the mills must be free from seams, flaws, or cracks; and must have a clean, smooth finish.

GENERAL PROVISIONS ON METHODS OF TESTING.

Testing

Rivet rods and other rounds are to be tested in the form in which they leave the rolls, without machining.

Test pieces from angles, plates, shapes, etc., shall be rectangular in shape, with a cross-sectional area of preferably about one-half ($\frac{1}{2}$) of a square inch, but not less, and shall be taken so that only two sides are machine finished, the other two having the surface which was left by the rolls.

Should fracture occur outside of the middle third of the gauge length, the test is to be discarded as worthless, if it falls below the standard.

If any test piece have a manifest flaw, its test shall not be considered.

Retesting

In case that one piece fall slightly below the requirements in any particular, the Inspector may allow the retesting of the lot or heat by taking four (4) additional tests from the said lot or heat; and if the average of the five shall show that the steel is within the requirements, the metal may be accepted; otherwise it shall be rejected.

Drillings for chemical analysis may be taken either from the preliminary test piece or from the finished material.

The speed of the machine for breaking test pieces shall not be less than one-quarter ($\frac{1}{4}$) inch per minute nor more than three (3) inches per minute.

Materials. Re-wrought

Material which is to be used without annealing or further treatment is to be tested in the condition in which it comes from the rolls. When the material is to be annealed or otherwise treated

before being used, the specimens representing such material may be similarly treated before testing; but they shall also give standard elongation, reduction, and fracture before annealing.

BENDING TESTS.

"Specimens of soft steel shall be capable of bending to one hundred and eighty (180) degrees and closing down flat upon themselves, without cracking, when either hot, cold, or quenched. Bending Tests

Specimens of medium steel when heated to a dark orange and cooled in water at seventy (70) degrees Fahrenheit, or when cold or hot, shall be capable of bending one hundred and eighty (180) degrees around a circle whose diameter is equal to the thickness of the test-piece, without showing signs of cracking on the convex side of the bend.

DRIFTING TESTS.

Punched rivet holes in medium steel, pitched two (2) diameters from a sheared edge, must stand drifting until their diameters are fifty (50) per cent. greater than those of the original holes, and must show no signs of cracking the metal. Drifting Tests

FRACTURE.

All broken test pieces for both classes of steel must show a silky fracture of uniform color.

WORKMANSHIP.

All metal shall be straightened carefully before being turned over to the shops. Workmanship

All workmanship shall be first-class in every particular, and all portions of metal-work exposed to view shall be neatly finished.

All idle corners of plates and angles, such, for instance, as the ends of unconnected legs of angle lacing, shall be neatly chamfered off at an angle of about forty-five (45) degrees, so as to give a sightly finish to the work and to avoid bending of said corners during shipment and erection.

As far as practicable, all parts shall be so constructed as to be accessible for inspection and painting.

All punched work shall be so accurately done that, after the various component pieces are assembled and before the reaming is commenced, forty (40) per cent. of the holes can be entered easily by a rod of a diameter of one-sixteenth (1-16) of an inch less than that of the punched hole; eighty (80) per cent. by a rod of a diameter of one-eighth ($\frac{1}{8}$) of an inch less than same; and one hundred (100) Punching

per cent. by a rod of a diameter one-quarter ($\frac{1}{4}$) of an inch less than same. Any shopwork not coming up to this requirement will be subject to rejection by the Inspector."

These requirements for accuracy in punching were formulated some six years ago by Mr. Frank C. Osborn, C. E., of the Osborn Engineering Co., and by me working jointly. They are by no means too severe, and yet are rigid enough to insure truly first-class shopwork. It is only the good shops, though, that can comply with such requirements.

FIELD RIVETING.

Field Riveting

"All field riveting shall be done by pneumatic riveters of a type to be approved by the Engineer, except in places where it is impracticable to use the apparatus, in which case hand riveting will be permitted."

The quality of pneumatic riveting is far superior to that of hand riveting and but little inferior to that of the machine riveting done in the shops. The use of the pneumatic riveters for field work has permitted the adoption of much longer riveted spans than were built when all field riveting was done by hand. Not only are the rivets driven by the pneumatic machine much tighter, but more than twice as many can be driven per day with the same force of men as compared with hand-driven rivets.

PUNCHING AND REAMING.

Punching and
Reaming

"All rivet-holes in steelwork, if punched, shall be made with a punch one-eighth ($\frac{1}{8}$) inch in diameter less than the diameter of the rivet intended to be used, and shall be reamed to a diameter one-sixteenth ($\frac{1}{16}$) inch greater than that of the said rivet.

Before this reaming takes place, all the pieces to be riveted together shall be assembled and bolted into position, then the reaming shall be done; for one of the principal objects of this clause in relation to sub-punching is to insure the correct matching of rivet-holes and the avoidance of holes of excessive diameter. The said clause also insures the removal of most, if not all, incipient cracks started by the process of punching.

All reaming is to be done by means of rigid twist-drills, the use of tapered reamers being prohibited, except where rigid twist-reamers cannot be employed. All holes must be at right angles to surface of member, and all sharp or raised edges of holes under heads must be slightly rounded off before the rivets are driven

All holes for field rivets, excepting those for lateral or sway

bracing, when not drilled to an iron template, shall be reamed while the connecting parts are temporarily assembled.

Punching shall not be permitted in any piece in which the thickness of the metal exceeds the diameter of the cold rivet that is to be used; but all such pieces shall be drilled solid."

For the last ten years I have been fighting hard to have all important metal sub-punched and reamed, and have succeeded as far as my own work is concerned; for the Contractors have at last ceased telling our clients how much money could be saved on the work by omitting the sub-punching and reaming. If any one has any doubts about the necessity for this treatment of the metal, he can set them finally at rest in one of two ways—by reading my résumé of the discussions on my paper upon "Elevated Railroads," published in the "Transactions of the American Society of Civil Engineers," or by inspecting in the shops before the reaming is done a lot of assembled metal, running his finger into a number of the holes, and noting the great irregularities that the rivets will have to fill, if the holes be punched full size.

SHIPPING.

"All parts shall be loaded carefully so as to avoid injury in Transportation transportation and shall be at the Contractor's risk until erected and accepted.

In shipping long plate-girders, great care is to be taken to distribute the weight properly over the two cars that support them and to provide means for permitting the cars to pass around curves without disturbing the loading. In both the handling and the shipment of metalwork every care is to be taken to avoid bending or straining the pieces or damaging the paint. All pieces bent or otherwise injured will be rejected."

The preceding clauses have all related to the superstructure of bridges; those immediately following will relate to the substructure.

POSITION OF PIERS, PEDESTALS, AND ABUTMENTS.

"All piers, pedestals, and abutments, when finished, must be in Lines and Levels exact position and to exact elevation; and all anchor-bolts therein must be located with the greatest exactness in respect to both horizontal position and elevation.

The Contractor must provide all guide-piles, anchors, cables, frames, and forms that may be required to insure the result."

The placing in exact position of all piers is one of the most difficult feats that the substructure contractor has to accomplish;

consequently it is evident that this requirement is an absolute necessity.

DEPTHS OF FOUNDATIONS.

Foundation Depths

"All cribs, footings, and caissons are to be sunk to the depths shown on the Engineer's plans or to such other depths as the Engineer may deem necessary as the work progresses.

The data furnished to bidders by the Engineer regarding depths of foundations or of bed rock are to be considered as merely approximate; and bidders must assume the risk of having to go a greater or less depth without altering in any way their schedule prices. If, however, the Engineer consider that the Contractor is really entitled to extra compensation on account of material variation from the data furnished, such extra compensation will be allowed, but the amount thereof shall be determined solely by the Engineer.

Borings

If, too, during the progress of the work, the Engineer deem that further investigations concerning the elevations of bed rock or quality of materials for foundations are necessary, the Contractor shall make at his own expense, under the direction of the Engineer, all the borings or similar investigations which the latter may consider to be requisite.¹

ENCOUNTERING OBSTACLES.

Unforeseen Obstructions

Bidders must figure on taking their chances of encountering logs, boulders, and other obstacles under the river bed at the pier sites; and the Contractor must provide himself with all the necessary tackle and apparatus for handling the same. There will be no extra price allowed because of the difficulty in sinking, or in driving through, or in removing said obstacles."

Risks

Some contractors complain that this clause is too severe, in that it places upon them the entire responsibility and risk involved in case of meeting with unexpected obstacles; nevertheless, it is both fair and necessary. If the Contractor were paid extra on account of obstacles, there would be no end to his claims for increased compensation, and the amounts of these claims might be excessive, because he would probably fail to make at the outset proper provision for removing all obstructions, while, if the *onus* were on him, he would undoubtedly provide everything necessary.²

¹ The obligations of the Contractor should be definite in amount and character.

² This depends upon who is to bear the risks of the undertaking; the Owner or the Contractor. Contractors are not generally in the insurance business, and their investigation is not usually as extended as is that by the Owner and its or his Engineers. The Engineer is best qualified to make a contract of indemnity or of insurance.

PILE FOUNDATIONS.

"Where piers and abutments are to rest on piles, the earth is to ^{Piling} be excavated to the depth required, the boxing timber is to be put in, if any be called for on the plans or by the Engineer, then the piles are to be driven to the satisfaction of the Engineer, and cut off at the proper elevation, then the earth that has risen between the piles is to be removed, and the bed is to be rammed, if the Engineer so direct. The length and penetration of all piles are to be determined by the Engineer.¹

If it be practicable to pump out the water in the pit and keep ^{Pumping} the latter clear of same without injury to the unset concrete, this is to be done while the concrete is being tamped around the piles to within two (2) feet of the tops thereof, and until the concrete has set; otherwise, concrete of the same kind as hereinafter specified for the tops of concrete piers is to be placed between and around the piles by means of a trémie, being carried up to the height just specified; and after the same has set the water is to be pumped out, and the remainder of the footing is to be built of ordinary concrete laid in the dry.

CONCRETE PIERS AND ABUTMENTS.

All piers and abutments are to be built of broken stone concrete; ^{Concrete} but the Contractor will be permitted to mix therewith a portion of clean gravel in order to reduce the percentage of voids in the broken stone.

The proportions for concrete without gravel for all interiors and footings of piers and abutments shall be as follows:

1 part of Portland cement.

3 parts of clean, coarse, sharp sand.

5 parts of broken stone to pass a two and one-half (2½) inch iron ring.

Where gravel is mixed with the stone, the proportions for the said concrete are to be as follows:

3 parts of sand as above.

5 parts of mixed broken stone and gravel, with enough cement to more than fill all voids in the mixture by ten (10) per cent., and in no case less than one barrel (380 lbs. net) of cement per cubic yard of concrete. The determination of the volume of voids shall be left to the Engineer.

¹ Amount and character of work should be specified if possible.

For exterior concrete work and for all concrete to be deposited, before setting, in water, the proportions are to be as follows:

1 part of Portland cement.

2 parts of sand.

3 parts of fine broken stone, to pass through a three-quarter ($\frac{3}{4}$) inch iron ring.

The exterior six (6) inches of all faces of piers and abutments that are exposed to the atmosphere or to water, are to be built of the rich small-stone concrete just described; and this is to be mixed and placed simultaneously with the other concrete, so that there shall be no division whatever, but a perfect bond between the two classes of concrete.

Forms

Suitable forms of timber properly lined with oiled sheet iron must be provided to give the constructions the exact dimensions and the finish shown on the drawings. Care must be taken to make all forms strong enough to resist the ramming of the concrete without bulging out or in any way changing their position.

No forms are to be removed until after the concrete deposited therein has stood thirty-six (36) hours, or as much longer as the Engineer may deem necessary.

Tamping

The exterior concrete is to be tamped solidly against the sheet-iron forms, so that there will be no voids on the exterior surface, which is to be left permanently as it comes from the moulds, unless the Engineer deem that the surface is too rough, in which case the Contractor must put on a smooth, two-to-one mortar finish to the satisfaction and acceptance of the Engineer.

All interior and footing concrete is to be deposited in layers not exceeding nine (9) inches in thickness, and each layer is to be thoroughly rammed.

DRY SURFACES IN CONCRETE.

Clean Surfaces

Should, during construction, any surfaces of the concrete be allowed to harden or dry before other concrete is placed thereon, they shall be swept perfectly clean with brooms, then wetted thoroughly with clean water, so as to make a perfect contact between the old and the new work, and thus insure that the concrete shall be truly monolithic. The forming of such dry surfaces shall, however, always be prevented, if practicable.

CEMENT.

Cement

All cement used on the work must be Portland cement of the very best quality obtainable, equal in every respect to the best

brands of American and European manufacture, and delivered at site in strong, close barrels, well lined with paper so as to be reasonably secure from air and moisture, unless the Engineer give the Contractor written permission to deliver it in bags.

Each barrel shall be labeled with the name of the brand, place made, and name of manufacturer.

The cement shall be ground so fine that at least ninety-seven (97) per cent. in weight will pass a standard sieve of five thousand (5,000) meshes to the square inch, and so that at least ninety (90) per cent. will pass a standard sieve of ten thousand (10,000) meshes per square inch. Fineness

When moulded neat into briquettes and exposed three (3) hours, or until set, in air and the remainder of twenty-four (24) hours in water, it shall develop a tensile strength of from one hundred (100) to two hundred and fifty (250) pounds per square inch. When moulded neat into briquettes, after exposure of one (1) day in air and six (6) days in water, it shall develop a tensile strength of from two hundred and fifty (250) to five hundred (500) pounds per square inch; and after exposure of one (1) day in air and twenty-seven (27) days in water, it shall develop a tensile strength of from four hundred (400) to six hundred (600) pounds per square inch. It shall be an eminently slow setting cement, must develop its strength gradually, and must show no drop therein. When moulded neat into pats with thin edges and left to set in either air or water, whether on glass or not, the said edges must show no signs of checking. The cement shall withstand properly the standard twenty-four (24) hour boiling test for Portland cement. Cement Tests

The cement, when mixed neat with twenty-two (22) per cent. of water to form a stiff paste, shall, after thirty (30) minutes, be indented perceptibly by the end of a wire one-twelfth (1-12) inch in diameter, loaded to weigh one-quarter ($\frac{1}{4}$) pound.

The hard set, determined similarly with a wire one twenty-fourth (1-24) inch in diameter and loaded so as to weigh one pound, shall not occur in less than three (3) hours.

Briquettes mixed in the proportion, by weight, of one part of cement to three (3) parts of sand, and kept one day in air and the remaining time in water, shall show a tensile strength of from one hundred (100) to one hundred and fifty (150) pounds per square inch after twenty-eight (28) days. Briquettes

Briquettes left in moulds and placed in water immediately after mixing must harden to the satisfaction of the Engineer, so as to

prove the fitness of the cement for setting under water. This test may be made a comparative one by pitting the cement tested against brands of established reputation. Any cement not hardening under water to the satisfaction of the Engineer will be rejected. Cement must work well under the trowel; otherwise it will not be accepted.

In any case, the cement adopted must first be approved by the Engineer.

Cement Storage

The Contractor shall provide a suitable building for storing the cement, in which the same must be placed before being tested. The Engineer shall be notified of the receipt of cement for testing at least two (2) weeks before it is required for use, and the Inspector may take a sample from each package for the said testing.

Any cement that has caked so as, in the opinion of the Engineer, to be injured shall be rejected, and shall be removed immediately by the Contractor from the neighborhood of the site, in order to avoid all possibility of its being used on the work.

BACK-FILLING.

Back-filling

As soon as the masonry or concrete work thereon is completed, the space around each shore pier and abutment shall be filled with earth, preferably clay, thoroughly dampened, and well rammed in layers not exceeding six (6) inches in thickness. There will be no direct payment for this back-filling, as the cost is to be covered by the price for concrete.

LIQUIDATED DAMAGES.

Liquidated Damages

For each day of delay beyond the date set in the contract for completing the Big Brazos River and Brushy Creek No. 1 bridges, all in accordance with the plans, specifications, and directions of the Engineer, the Company shall withhold permanently from the Contractor's total compensation the sum of one hundred dollars (\$100.00).

For each day of delay beyond the date set in the contract for completing the remaining eight (8) bridges, all in accordance with the plans, specifications, and directions of the Engineer, the Company shall withhold permanently from the Contractor's total compensation the sum of one hundred dollars (\$100.00).

The amounts thus withheld shall not be considered as a penalty, but as liquidated damages fixed and agreed to by the contracting parties."

Penalties

Let me call your attention to the term "Liquidated Damages," which is now employed instead of the older term "Penalty." If the

latter were used it would be illegal, as the courts hold that no individual or corporation has the right to enforce a penalty, such enforcement being within the jurisdiction of the law only, but liquidated damages fixed beforehand can be collected.

TENDERS.

"Each bidder shall tender as follows:

Proposals

1st. For removal of old spans, marking all the pieces of same, and piling these as per instructions of the Engineer, dollars per lineal foot of span removed.

2d. For removal of old masonry and distributing same, dollars per cubic yard.

3d. For concrete in shafts of new piers and rebuilt portions of old piers, dollars per cubic yard.

4th. For mass in place of pneumatic pier, including excavation, dollars per cubic yard.

5th. For mass in place of foundations for all piers and abutments, including those portions of piles imbedded in the concrete, and including the excavation, dollars per cubic yard.

6th. For those portions of piles in place below the concrete of the foundations, cents per lineal foot of pile.

7th. For all structural metal in superstructure of pin-connected span, erected and painted, cents per pound.

8th. For all structural metal in all other spans, erected and painted, cents per pound.

9th. For floor timber in place, excluding dressing and all other wasted timber, dollars per M. feet, B. M.

10th. For laying rails, cents per lineal foot of track.

11th. For falsework under the existing spans that are to be left in the reconstructed bridges, dollars per lineal foot of span.

For all other items not covered in this list the Contractor is to be paid the actual cost to him thereof plus ten (10) per cent. for his profit. He must, however, in such cases furnish vouchers satisfactory to the Engineer for all materials and labor involved in such extra work or construction.

Tenders are to be sent in sealed envelopes to the undersigned Tenders Consulting Engineers, New Nelson Building, Kansas City, Mo. They will be received up to noon of Thursday, July 17, 1902.

The Company reserves the right to reject any or all bids."

Unit Prices

It will be noticed that all items of work are to be paid for at schedule rates, and that lump-sum payments are avoided. This is by far the better and more equitable method of compensation; because, if the final quantities vary from those bid upon, no harm will be involved, the Contractor being paid only for what he actually does. If the lump-sum basis of payment be employed, the Contractor will be constantly tempted to cut down the quantities of materials furnished, but when these are paid for by schedule prices no such temptation can exist.¹

Example, Lighthouse

The following are a few specific clauses from our "Specifications for Lighthouses at Jutias Cay and Punta Gobernadora, on Colorados Reef, Island of Cuba." I have chosen only such items as are characteristic of lighthouse construction.

GENERAL DESCRIPTION.

LIGHTHOUSE AT JUTIAS CAY.

General Location

"This Lighthouse will be located on the Northeast extremity of Jutias Cay, at a distance of about eighty-seven (87) meters from the water's edge. The location is well protected from the action of the waves by a reef in front and by the growth of mangroves. The height of the ground at the site is about nine-tenths (0.9) of a meter above the sea-level.

Investigation

The soundings made at the site show that the ground is composed of fine sand for a depth of from four (4) to five (5) meters, then of sand, shells, and coral rock for a depth of about eight-tenths (0.8) of a meter, and this is underlaid with sand and shells, in which are imbedded pieces of coral rock that become more abundant as the depth increases. It is intended that the screw-piles shall rest on this layer. These piles are of steel shafting fitted with cast-iron screw points as shown on the drawings.

Description

The light for this structure will be a fixed one. The tower will be constructed of eight (8) steel columns arranged in the form of an octagonal pyramid, the long diameter of which will be fifty-six (56) feet at the base and fifteen (15) feet at the top. These columns are to be thoroughly braced in all directions with steel struts and diagonal rods as shown on the drawings.

There will be a house located at the base of the tower, and a watch-room located in the top of same. There will also be a stairway

¹ Limitations and restrictions imposed by municipal charters, legislatures, and constitutions must be considered, which frequently require that the total expenditure authorized by the contract shall be determined and shall not exceed a fixed sum or the appropriation.

extending from the base to the watch-room floor enclosed by a mantel. These enclosures are to be constructed of steel plates, and the interior walls are to be plastered on expanded metal lath.

LIGHTHOUSE AT PUNTA GOBERNADORA.

This structure will be placed on the mainland at a point known as Punta Gobernadora, about six (6) miles west of Bahia Honda. The distance from this tower to the edge of the water will be about one hundred and fifty (150) meters. The site is protected from the action of the waves by reefs on the outside. The formation here is an extensive bed of limestone-coral rock, and the surface is practically level.

The light for this structure will be movable.

In all other respects the superstructure will be the same as described previously for the lighthouse at Jutias Cay.

FOUNDATIONS

FOR LIGHTHOUSE AT JUTIAS CAY.

The foundation for this structure will consist of nine (9) screw piles, as shown on Sheet No. 2, eight (8) of which are placed in the form of an octagon around the axis of the ninth (9th) or central pile. The long diameter of the octagonal base is to be fifty-six (56) feet, and each of the sides twenty-one (21) feet and five and one-eighth ($5\frac{1}{8}$) inches.

These piles are to be formed of solid steel shafts eight (8) inches in diameter, at the lower end of each of which is to be fitted a cast-iron screw, the blades thereof to be four (4) feet in diameter. The lower end of the screw is to finish in a point.

The exact depth to which these piles must go has not been determined, but it will be from eighteen (18) feet to twenty-five (25) feet below the surface of the ground. The Contractor must provide twenty-five (25) feet of shaft and a pile cutter and screw cutter, so as to cut off the piles and thread them at the proper height after screwing them down as far as they will go.

After the piles are in place and the tops are cut to the proper elevation, concrete pedestals, as shown on Sheet No. 2, are to be placed around them; and on these pedestals, screwed to the tops of the piles, will rest the shoes for the steel columns of the tower.

The elevations and dimensions for these foundations are given on Sheet No. 2.

STEEL STAIR MANTEL.

Cylinder Shafts

The spiral stairs will be enclosed in a steel cylinder, the axis of which is coincident with the axis of the tower. The diameter of this steel cylinder will be seven (7) feet. It is to be formed of steel plates one-quarter ($\frac{1}{4}$) of an inch in thickness, the larger dimensions of which are to be arranged vertically with the edges abutting and the joints spliced with four (4) inch by one-quarter ($\frac{1}{4}$) inch plates placed on the inside.

The lower end of this cylinder is to rest on the center pile and its concrete pedestal. All rivets in the stairway cylinder are to be one-half ($\frac{1}{2}$) inch in diameter. In the lower section of the cylinder a door is to be placed, and at a height of three (3) feet above each stairway landing there is to be fitted a cast iron window frame. All windows are to be arranged as nearly as practicable at points ninety (90) degrees apart around the cylinder, and they must come about midway between the two columns on that side of the pyramid.

The inside of the stairway cylinder is to be provided with angles for attaching three-quarter ($\frac{3}{4}$) inch channels and expanded metal lath, as the entire inside of the cylinder is to be finished with plaster.

SPIRAL STAIRS.

Stairways

The spiral stairs will consist of one hundred and forty-eight (148) risers, including eight (8) quarter ($\frac{1}{4}$) circle landings, which divide the ascent into nine (9) flights, eight (8) of which are twelve (12) feet nine (9) inches each in height, and containing seventeen (17) risers of nine (9) inches each, and one flight of nine (9) feet, containing twelve (12) risers of nine (9) inches each.

Steps

The steps are to be of cast iron, the extreme radius of each being three (3) feet. Each step comprises a tread of twenty-two and one-half ($22\frac{1}{2}$) degrees of the circle, between the centers of the one-half ($\frac{1}{2}$) inch bolts which will secure the steps to each other.

The inner end of each step is provided with a hub six and five-eighths ($6\frac{5}{8}$) inches outside diameter, which must be faced on its upper and lower ends to exactly nine (9) inches deep, and must be bored out to five and one-half ($5\frac{1}{2}$) inches in diameter so as to fit snugly over the newel pipe.

The treads are one-half ($\frac{1}{2}$) inch thick and are perforated with lozenge-shaped openings one (1) inch wide. The gratings are one-half ($\frac{1}{2}$) inch wide, and at their inner sections the steps are studded with lozenge-shaped projections to prevent slipping; and for the same reason a half-round bead one-eighth ($\frac{1}{8}$) inch high is raised along the front edge of each step.

The bolt sleeves at the front of each step are to be nine (9) inches high and deeply counter-sunk on the upper side for the heads of the stair-bolts.

All surfaces of contact between the sleeves of the adjoining steps must be planed.

NEWEL POST.

The newel post will be made of double-strength, wrought-iron water-pipe, five (5) inches inside diameter, and turned on the outside to a diameter of five and one-half ($5\frac{1}{2}$) inches. At each joint the ends must be faced so as to give perfect contact, and the joints must be so arranged as to bring them midway of the length of the hubs of the steps. On the inside the pipe must be spliced with a threaded coupling.

The newel pipe should be made in seven (7) lengths of about sixteen (16) feet each, as nearly as may be, to bring the joints as stated above.

The base of the newel pipe will be provided with a steel flange, which will be tap-bolted to the cast-iron base at center.

Throughout the whole height of tower the newel must stand perfectly plumb.

In the case of the Punta Gobernadora Lighthouse the cord of the revolving apparatus will be run through the center of the newel pipe, and pulleys near the upper and lower ends of the pipe must be provided.

The upper end of the top section of the newel pipe will extend a short distance into the hub of the watch-room floor.

DWELLING HOUSE.

The entire space included between the columns at the base of the tower is to be enclosed with steel walls so as to form a dwelling. This space is to be divided into nine (9) outside rooms and an inner court. The walls and roof of this building are to be of one-quarter ($\frac{1}{4}$) inch steel plates of the style and dimensions indicated on Sheet No. 5. All rivets are to be one-half ($\frac{1}{2}$) inch in diameter unless otherwise noted on the drawings.

The floor will be of concrete, supported on No. 16 expanded metal and steel I-beams. There will be three and one-half ($3\frac{1}{2}$) inches of broken stone or cinder concrete, mixed in the proportion of one (1) part of Portland cement, three (3) parts of clean, sharp sand, and five (5) parts of broken stone or cinders to pass a one and one-half ($1\frac{1}{2}$) inch iron ring. On this concrete base there is to be

laid one (1) inch of cement finish, mixed in the proportion of one (1) part of Portland cement and one (1) part of clean, sharp sand. The entire surface is to be floated to a smooth, even finish.

Partitions

All partitions are to be constructed of three-quarter ($\frac{3}{4}$) inch channels, set vertically and spaced eighteen (18) inches centers, on which is to be wired No. 20 expanded metal lath; and the two surfaces are then to be plastered with two coats each of hard wall-plaster. The interior of outside walls and the ceilings are to be finished in the same manner as the partitions. The rooms are to be ventilated by registers in the ceiling, and openings are to be left in the walls of the stairway mantel to conduct the air from the space between the ceiling and the roof and from the open court to the top of the mantel, all as shown on the drawings. Doors and windows are to be provided in the house, as shown in the plans.

Roof

Around the edge of the roof an eight (8) inch gutter of cast iron is to be placed. This gutter is to be three-eighths ($\frac{3}{8}$) of an inch thick, and is to be cast in lengths of about ten (10) feet. It will be supported at the corners and at the center of each side with brackets constructed of two (2) inch by three-eighth ($\frac{3}{8}$) inch flat steel bars. Bell joints are to be provided, and they are to be thoroughly caulked with lead. The gutter is to have a slope of one (1) inch in twenty (20) feet. Two (2) conductors of six (6) inch wrought-iron pipe are to be provided with the necessary elbows and other fittings to carry the water from the gutter to the cast-iron tank in the yard. The pipe is to have a flange resting on the cover of tank and is to extend six (6) inches into same.

Concrete steps are to be provided at the two entrances of the building.

Holes are to be provided in the roof for the stove-pipe ventilators mentioned under "Hardware."

For details of dwelling see Sheet No. 5.

WOODWORK.

Carpentry

The woodwork for these buildings will consist of the windows and doors, their frames and casings, and the closets and cupboards. All woodwork will be of clear white pine, thoroughly seasoned, free from all shakes, sap, and other defects. All workmanship is to be first-class. All doors and sash are to be one and three-fourths ($1\frac{3}{4}$) inches thick, and are to have rain channels plowed as shown on drawings. Casement windows and double doors are to have moulded oak joint-strips inside and out.

All outside doors leading to the central court of dwelling, doors in stairway and watch-room, and the two doors from office to bedrooms, are to have upper panels of glass, as called for on drawings. All doors and sash are to be neatly moulded and well pinned and glued.

All junctions of plaster and woodwork will be covered by one and one-quarter by one and three quarter ($1\frac{1}{4} \times 1\frac{3}{4}$) inch moulding. This moulding will form the casing of all doors and windows. A closet is to be provided in one corner of each bedroom, two (2) of them in the office, and a cupboard in each kitchen.

The cupboards are to be eight (8) feet six (6) inches in height, and are to be divided into two (2) compartments. The lower compartments are to be three (3) feet six (6) inches high, and are to have only a bottom shelf, each upper compartment having four shelves besides the division shelves. Cabinets

Drain boards two (2) feet long are to be provided for each sink.

The lower compartments of closets are to be (2) feet six (6) inches high, and they are each to have three (3) shelves; the upper compartments are to have only one shelf at top. For details see Sheet No. 5.

All woodwork is to be surfaced, sand-papered, and primed on both sides before leaving the shop. It must be kept dry and must be securely boxed for shipment. Woodwork

All woodwork is to be treated by some process, to be approved by the Engineer, so as to render it non-combustible."

The following are some characteristic specific clauses from our "Specifications for a Steel Pier to be built in the Harbor of Vera Cruz, Mexico, for the Vera Cruz and Pacific Railway Company": Example, Steel Pier

GENERAL DESCRIPTION.

"The structure will consist of a platform of creosoted timber, four hundred and ninety-two (492) feet long by seventy-four (74) feet wide, resting on steel joists, spaced about four and one-half ($4\frac{1}{2}$) feet centers, which in turn rest on double I-beam girders that are supported at intervals of fourteen (14) feet six (6) inches by screw piles. Description

These piles are thoroughly braced so as to form independent towers with four (4) piles to each tower, the bracing extending from the top down to, and in some cases even into, the sand.

At the middle of the platform and extending over its entire length is a double-track railway, the rails for same resting on and

spiking to the six (6) inch timber floor, of which the platform is composed. Between the rails is laid four (4) inch planking, and beyond the outer rails are beveled planks, all to facilitate the passage of trucks and vehicles over the rails.

Around the entire periphery of the two sides and the outer end of the pier runs a twelve (12) inch by twelve (12) inch timber fender, bolted firmly to the metal work; and on each side of the pier there are located at intervals five (5) cast-iron mooring posts.

Each railway track is supported by four (4) runs of steel I-beams, braced together in pairs by diaphragms of steel channels.

The deck is swayed in a horizontal plane by adjustable diagonal rods that attach by clevises to the cast-iron caps over the piles.

The tower bracing consists of horizontal struts, each composed of two (2) six (6) inch by four (4) inch T's and diagonal rods adjusted by turnbuckles. The bracing is connected to the piles by forged steel clamps.

Piles

The piles, which are of seven (7) inch solid cylinders, are to be preferably in one length; but splices will be permitted, and, in fact, are provided for on the drawings.

The screws are to be of cast iron, four (4) feet nine (9) inches in diameter, and are to have sockets for receiving the ends of the steel piles. The shoes are held in place by means of steel pins passing through both the pile and the shoe.

The cross girders are to be bolted to the pile caps; the joists are to be riveted to the cross girders; the flooring is to be attached to the joists by lag screws and beveled washers; and the planking at railroad tracks is to be spiked to the flooring by eight (8) inch by one-half ($\frac{1}{2}$) inch square spikes, two (2) spikes being used for each running foot of plank.

MODUS OPERANDI OF CONSTRUCTION.

Conduct of Work

All piles are to be placed in as nearly exact position as it is practicable to get them. As no adjustment has been provided for in the bracing struts, the four (4) piles forming a tower must be sunk within an eighth ($\frac{1}{8}$) of an inch of true position. In order to secure such an accurate location with reference to each other, some form of portable, convenient, and rigid template must be used to set and hold the four (4) piles of each tower to exact position during sinking. The Contractor, before proceeding with the work, shall submit to the Engineer for approval a complete description and plans, explaining fully the method he proposes to adopt.

The power applied for screwing the piles in place shall not be great enough to strain them in torsion beyond the elastic limit of the material.

Great care must be exercised to get the piles down to exact elevation.

All bracing must be put in under water by divers. All clamps must grip the piles so tightly that they will develop the full strength of the diagonal rods attaching to them, without slipping. All diagonal rods must be tightened and adjusted to the satisfaction of the Engineer.

After the bracing is adjusted all towers must stand plumb, and the plan of each tower must be a perfect square.

Before the timber floor is put on, the upper lateral diagonals must be carefully adjusted so as to bring the platform to perfect alignment.

All sand and silt that would interfere with the placing of the bracing, as shown on the plans, must be removed; and there will be no direct payment for this removal, as its cost must be covered by the pound-price bid for the erected metal.

BORINGS.

Very thorough borings have been made by the Company's Borings engineers and the results thereof are shown on Sheet No. 1 of the accompanying plans. Although the said borings indicate that no unusual difficulty will be encountered in sinking the piles because of obstacles in the sand, it is possible that such obstacles do exist, and the Contractor must take the risk of encountering them, as there will be no extra compensation allowed therefor.

PILES.

All piles shall be sunk to exact position by means of adequate Pile Driving machinery, power, and guide frames, all of which, before being used, must be approved by the Engineer. Such approval, though, shall not be interpreted as giving the Contractor any claim whatsoever for avoidance of responsibility in respect to correctness of final position of piles.

All piles are to be screwed down to the elevations shown on Sheet No. 1; but if there be any slight inequality in elevations of tops of piles, the same shall be adjusted by means of thin, cylindrical shimming plates, seven (7) inches in diameter, to be placed between the heads of the piles and the cast-iron caps. Should any pile be left too high, its top shall be sawed off to exact level; but, as this

would be expensive, the Contractor should endeavor to sink all piles a trifle low, so as to shim upon each a small amount. He should also provide an ample number of shimming plates of various thicknesses. The greatest variation of height of column to be taken up by shimming plates shall in no case exceed one and one-half ($1\frac{1}{2}$) inches.

No variation in elevation of tops of pile castings exceeding one-sixteenth ($1/16$) of an inch will be permitted. The spaces between the pile heads and sockets of castings shall be filled completely with hot, thick asphaltum, by putting an excess thereof in the casting just as the latter is about to be placed, and the said asphaltum must be held permanently in the annular space by caulking tightly with sheet lead from below.

This work must all be done to the satisfaction and acceptance of the Engineer, and there will be no direct payment made for either lead, asphaltum, or labor involved in putting these in place, as the pound-price for the metal-work must cover the cost of these materials and labor.

PAINTING.

Painting

All metal-work before leaving the shop shall be thoroughly cleansed from all loose scale, rust, and dirt, and shall then be given one coat of paint, which coat shall be thoroughly dried before the metal-work is loaded for shipment. It is absolutely essential that the entire surface of the metal-work be thoroughly cleansed by the most effective known methods, such as the use of wire brushes, then the painter's torch, and in certain cases the application of a strong caustic solution, followed by scraping, washing with clean water, and drying.

In riveted work all surfaces coming in contact shall be extra well painted before being riveted together. Bottoms of bed-plates, bearing-plates, and any other parts which are not accessible for painting after erection shall have three (3) coats of paint, one at the shop, and the other two in the field before erection. Pins, bored pin-holes, and all other polished surfaces shall be coated with white lead and tallow before shipment from the shop.

Oil should be used as the lubricant for reaming, but, should soap-suds be employed, all parts of the metal affected thereby must be washed thoroughly and dried before any painting is done thereon.

After the structure is erected, the metal-work shall be thoroughly cleansed from mud, grease, or any other objectionable material that

may be found thereon, then thoroughly and evenly painted with two (2) coats of paint.

The paint to be used on the metal-work is known as Leiter's Paints Air-Drying Paint, sold by the L. Z. Leiter Co., 81 South Clark street, Chicago, Ill., and costing there one dollar and twenty-five cents (\$1.25) per gallon. The Engineer reserves the right to substitute any other paint, which, in his opinion, is equally good or better for resisting the corrosive effects of salt water.

All three coats of paint given to the metal-work are to be of distinctly different shades or colors, and the second coat must be allowed to dry thoroughly before the third coat is applied.

No thinning of paint with turpentine, benzine, or other thinner will be allowed without special written permission from the Engineer.

No painting is to be done in wet weather.

All painting is to be done in a thorough and workmanlike manner, to the satisfaction of the Engineer, and no paint whatever is to be used on the structure without first being approved by the Engineer.

All materials for painting shall be subject at all times to the closest inspection and chemical analysis, and the detection of any inferior quality of such material, in either shop or field, shall involve the rejection of all suspected material at hand and the scraping and repainting of those portions of the work that, in the opinion of the Engineer, were defectively painted on account of such inferior material.

All recesses that would retain water or through which water could enter must be filled with thick paint or some waterproof cement before receiving final painting. All surfaces so close together as to prevent the insertion of paint-brushes must be painted thoroughly by using a piece of cloth instead of the brush.

LOADING METAL-WORK ON VESSEL AND PREPARING SAME THEREFOR.

Pains must be taken to mark clearly every piece, bundle, or Shipping package with the shipping address and destination, with the names and numbers of pieces, and with any other such mark of identification as may be necessary to insure the correct disposition of the material.

All small parts, such as rivets, bolts, nuts, washers, pins, fillers,

small connection-plates, etc., shall be boxed strongly, and the contents shall be marked plainly on each box, in addition to the shipping address mentioned above.

All lateral angles shall be bolted together in pairs; and as many of such pairs shall be bundled together with clamps or wires as will be convenient for handling without injury in loading and unloading.

All pieces with open ends, such as truss-members with forked ends, or laterals with unsupported plates or angles, or any other parts liable to injury in handling, shall have the ends packed with heavy blocks of timber, bolted thoroughly between the projections or to the body of the member in such a manner as to prevent any bending or other injury in handling or on shipboard.

All nuts on any rods or bolts shipped loose shall be screwed tightly in place, and the threads thereof shall be wound closely with twine, so that the nuts cannot come loose and be lost off in handling.

The shipping invoices or lists are to be made to correspond to the bundles, boxes, and packages, so that each item on the list can be identified readily.

Loading

During both the loading on steamer and the unloading from same, special care shall be taken to avoid injuring any of the metal-work, and the loading shall be so done as not to overstrain unduly any part and so as to prevent any shifting during the voyage. If, in spite of all precautions, some of the metal-work be injured, the entire expense to which the Company is put because of such injury shall be borne by the Contractor.

All the expense involved by these special shipping and loading directions shall be borne by the Contractor, as no extra payment will be allowed therefor."

I desire to call your attention to the importance of including in specifications for metal-work that is to be transported by water full instructions for loading the material in such a manner as to reduce to a minimum the danger of injury in transit. Unless this matter receive due consideration in the specifications, and unless the latter be strictly lived up to in this particular, the metal is liable to be so damaged during transportation as to necessitate the rejection and replacement of some important parts, thus involving for the construction long and often serious delays.¹

¹ Provide for bill of lading and secure control of materials as against creditors and others, if possible.

The following characteristic clauses are taken from our "Specifications for Steel Pipe Line for the City of Kansas City, Mo.": Example, Pipe Line

GENERAL DESCRIPTION.

"The work is to consist of a buried pipe line, covered to a depth of at least three (3) feet above the top thereof. Description

The pipe shall be forty-eight (48) inches internal diameter (irrespective of the rivet heads), and shall be made of soft steel one-half ($\frac{1}{2}$) inch thick. Pipe

Bidders, however, shall tender also on a pipe of thirty-six (36) inches minimum internal diameter (irrespective of the rivet heads), made of soft steel three-eighths ($\frac{3}{8}$) of an inch thick.

All joints are to be lap-joints, the longitudinal ones being double-riveted, and the transverse ones single-riveted. Manufacture

The length of the over-lap for the longitudinal joints shall be five and one-half ($5\frac{1}{2}$) inches, and that for the transverse joints three (3) inches.

There shall be but one longitudinal joint in any section of pipe.

All rivets are to be of soft steel, three-quarters ($\frac{3}{4}$) of an inch in diameter and spaced two and one-half ($2\frac{1}{2}$) inches centers, as shown on the accompanying drawings.

The pipe is to be built in sections telescoping into each other, each section being seven (7) feet long, and there being four (4) sections riveted together in the shops, thus making the total length of pipe for shipment twenty-seven (27) feet three (3) inches from out to out, four (4) of such forty-eight (48) inch pipes making a carload.

The distance from center line of rivets to edge of plate is to be one and one-half ($1\frac{1}{2}$) inches.

The larger sections shall be of such internal diameter that the smaller sections will fit tightly inside them after the lap-joints have been drawn out to thin edges.

All joints are to be caulked so as to be absolutely water-tight under a three hundred (300) foot head.

The longitudinal joints are to be so located that, when the pipe is laid, they shall lie on top thereof alternately to right and left of the vertical axial plane, and so that the nearer row of longitudinal rivets shall be six (6) inches therefrom.

All pipe shall be formed to correct cylindrical shape, and any lengths discovered to be out of true will be rejected.

Where the pipe passes beneath any railroad track, it shall be stiffened as follows:

Six (6) longitudinal angle-irons 3 inches x 3 inches x $\frac{1}{2}$ -inch shall be spaced, as nearly as possible, equi-distant around the periphery of the pipe and riveted thereto, fillers being placed beneath them to afford a flush bearing. These angle-irons are to be twenty-seven (27) feet long, as they must run without splicing the full length of the four (4) continuous seven-foot sections.

At the middle of each seven-foot section there is to be a ring of 3-inch x 3-inch x $\frac{1}{2}$ -inch angles in six (6) pieces (so as to lie between the longitudinal stiffeners) riveted to the pipe.

Finally, there is to be a single 6-inch x $3\frac{1}{2}$ -inch x $\frac{1}{2}$ -inch angle-iron bent to a true circle with the long leg vertical, the said leg riveting to the vertical legs of the previously mentioned ring angles.

It will be necessary to notch the six-inch leg so as to straddle the radial legs of the longitudinal stiffeners.

The joint in this outer ring is to be placed opposite the middle of one of the six pieces of circular angle-iron, and the said joint is to be spliced with a piece of plate ten (10) inches wide, bent to fit outside of the 6-inch x $3\frac{1}{2}$ -inch angle.

The details of the stiffening are shown clearly on one of the accompanying drawings.

Where two of these stiffened pipes come together in the field, each opposing pair of longitudinal stiffeners is to be spliced by attaching to the vertical leg thereof a piece of 3-inch x 3-inch x $\frac{1}{2}$ -inch angle, two (2) feet long, riveted through one leg to the stiffeners and through the other to the pipe, there being four (4) rivets to each leg on each side of the joint.

FORMATION OF ANGLES AND CURVES.

Angles and Curves

Where angles or curves occur in the alignment or grade of the pipe line, the plates are to be cut and punched to the required bevel so as to produce an oblique angle at the circular seam, carrying this style of construction over a sufficient length of pipe to secure the total deflection required. It may in some cases be necessary to enlarge slightly the exterior lengths of pipe; but extra care will have to be taken to caulk all such oblique joints.

PROTECTION OF METAL.

Protection

The pipe shall be dipped vertically in a bath of Assyrian Asphalt, Smith's Durable Metal Coating, Mineral Rubber Coating,

or some other paint which, in the opinion of the Engineer, is equally as good as any of those just named.

The coating shall be heated to a temperature of four hundred (400) degrees F. or more, and all pipes shall receive a uniform coating of not less than one-thirty-second (1-32) of an inch in thickness.

After the sections have been removed from the dipping tank, they shall be set vertically to dry. All joints shall receive three (3) coats of paint before they are riveted up. All spots on which the coating has been injured in handling must be thoroughly recoated.

The particular kind of coating to be used will be decided later by the Engineer."

And now, although I have read many of these specific clauses simply by title, intending to let you study them thoroughly later on if you so desire, it appears to me that you have had about enough of this ultra-technical discourse, and that, if I don't cease talking pretty soon, you will be tempted to nickname me "Dr. Dryasdust"; consequently, I shall say no more about specifications, except that I advise every one of you to make a special study of the subject; first, by collecting and perusing carefully a number of truly first-class specifications written by engineers of wide experience; and, second, by attempting to write for yourselves specifications for various types of engineering construction. Remember that you cannot hope to learn to write even approximately complete and correct specifications until after you have had many years of practical experience in engineering work; therefore, do not be discouraged, if at first you find the task too great for your unavoidably limited experience.

In concluding this series of lectures, I beg to thank you, young gentlemen, for the attention and courtesy you have shown me and for the appreciation of my efforts that you have manifested.

Examples for Practice in Specification Writing.

Writing Specifications

Before the student attempts to write one of the specifications outlined in the following list, he should obtain and study one or more actual specifications for similar work. To this end the professor should make and retain for the use of his classes a large collection of good, sound specifications, dealing with the various types of construction covered in the list.

Adopting Others' Work

The student is warned against copying blindly from these documents, for they should be employed merely as guides to indicate the ground that ought to be covered in the specification that is about to be prepared. In case it is desirable to shorten the student's work, it will be proper for him to give merely the headings for various paragraphs that are of a standard nature, and to refer concerning them to certain well-known general specifications, such, for instance, as those of the author's *De Pontibus*; but it would not be right so to refer to any special specifications that are not available to the public. For example, it would be eminently correct to refer to *Cooper's Bridge Specifications*, but not to those of the *Pennsylvania Railroad Company*.

Drawings

If the student's specifications are assumed to have drawings attached, the first thing for him to do is to determine in his mind exactly of what these drawings should consist, how many sheets they should occupy, and what each sheet should contain; then he should prepare a descriptive list of them for insertion in the proper place in the specifications, which, by the way, is near the beginning.

Topics

The next step to take is to make a complete list of headings and then arrange these in proper order. On page 10 will be found an alphabetically arranged list of headings for certain specifications that can be used as a guide in determining the ground that the student should cover; and he is likely to obtain considerable assistance on this point by a perusal of actual specifications of a like character. The list of headings should be made in some logical order—*i. e.*, the various items should not be inserted at haphazard.

The best arrangement is perhaps chronological in respect to the building of the structure under consideration; but it is not practicable to follow this order rigidly throughout the entire document, for there are many items that are absolutely independent of any chronological sequence. Failing the latter, a good rule to go by is that one item ought naturally to suggest the succeeding one. If these two ideas be kept in mind and be allowed to govern, the result of the student's effort at technical writing will not be open to severe criticism because of want of proper continuity.

After the student has finished writing a set of specifications, and has numbered the pages thereof, he should prepare an alphabetical index of headings with the page numbers alongside.

The following forty examples are of a diverse character, consequently the student can have a choice of subjects; and, moreover, he can choose also as to the comparative difficulty or complexity of the specifications he is to write, because some of the examples are simple while others are not. None, however, are extremely difficult, but few of them being as complex as the average specifications of most engineers' every-day practice. Remarks

If the student find that the data given for any of these "Examples" are insufficient for his purpose, he will be at liberty to supply the omissions or deficiencies according to his best judgment.

All the specifications should be drawn with the idea in view of calling for tenders on the work.

EXAMPLE NO. 1.

Prepare complete specifications for a concrete retaining wall, Retaining Wall
from twelve (12) to twenty-one (21) feet high above base of footing course and twelve hundred and fifty (1,250) feet long, to hold back a sloping bank of earth, the foundations to be at least five (5) feet below the surface of the ground. Joints, to prevent cracking, are to be placed at intervals of not more than forty (40) feet. The work, which is located in New Westminster, British Columbia, is to be built by the Government of that Province. Payments are to be made monthly on the Engineer's estimates with the usual retention of ten (10) per cent. thereof until the completion of the contract.

Portland cement is to be used exclusively for the concrete. The wall is to be strictly first-class in every particular.

EXAMPLE NO. 2.

Prepare complete specifications for a concrete arch culvert ten Arch Culvert
(10) feet in diameter and one hundred and twenty-eight (128) feet

long, to be covered later by an earth embankment about forty (40) feet high. Location, near Buda, Texas, on the I. & G. N. Ry. Construction first-class throughout. The opening at present is maintained by a wooden trestle. Provide for non-interference with railroad traffic. The work must be done in the dry season when there is very little water passing.

EXAMPLE NO. 3.

Grading

Prepare complete specifications for doing all the grading (solid rock, loose rock, and earth) for a railroad fifty-four (54) miles long, starting at Palestine, Texas, and running northward.

EXAMPLE NO. 4.

Rock Tunnel

Prepare complete specifications for building a tunnel eight hundred and fifty-five (855) feet long through rock for a single-track railway that is not yet in operation, although the track reaches near both ends of the hill through which the tunnel is to pass. The roof may or may not need lining, for the character of the rock is as yet undetermined, except on the surface where it gives promise of being hard within.

Bids are to be called for per lineal foot of tunnel both unlined and lined.

EXAMPLE NO. 5.

Tunnel in Clay

The Metropolitan Street Railway Company had a tunnel along Eighth street in Kansas City, Mo., in which the grade was nine and one-half (9.5) per cent., and desired by starting at the west end to lower the bottom so as to change the grade to four and one-half (4.5) per cent. The material was stratified rock of a very variable character, full of faults and clay seams. On this account special care had to be taken to prevent caving in and bulging of sides, also undermining of roof. Small blasts were, therefore, necessitated.

No attempt was made to maintain traffic during the reconstruction.

Wherever soft material was found under the side walls it had to be removed and replaced with first-class Portland cement concrete.

From the east end of the tunnel to Broadway there was to be an open cut, mostly through earth, with substantial side walls of concrete. In doing this part of the excavation there was great danger of undermining the foundations of some adjacent high buildings. Assume that complete detail plans for the reconstruction were

on file at the Engineer's office of the Metropolitan Street Railway Company, and prepare a proper set of specifications on which to call for bids.

EXAMPLE NO. 6.

Prepare complete specifications for the manufacture and putting in place of a forty-eight (48) inch steel riveted pipe-line made of half-inch metal, about four and a half (4.5) miles long, with man-holes every five hundred (500) feet. General depth of top of pipe below surface of ground to be four (4) feet. There are six (6) under-crossings of railroad tracks requiring the pipe there to be properly stiffened so as to carry the weight of passing trains.

Pipe to be lap-jointed; rivets $\frac{7}{8}$ inch in diameter, staggered. Shop riveting to be done by power, and all field riveting by pneumatic hammers.

About fifteen (15) per cent. of the line is to be on curves, as shown by plans and profiles on file in the City Engineer's office at Des Moines, Iowa, near which city the line is to be built to convey the main water supply for the said city.

The pipe is to be tested in sections under a static pressure of one hundred and thirty (130) pounds per square inch.

Time limit for completion of work is to be eight (8) months.

Bids are to be per pound of pipe in place, and per cubic yard of earth and rock excavated, including backfilling.

Special attention must be given in the specifications to the painting of pipe and to making it perfectly tight.

The student will be at liberty in this "Example" to refer to certain clauses in the specifications of De Pontibus, or other standard specifications for steelwork, so as to shorten his labor as much as possible.

EXAMPLE NO. 7.

Prepare the specifications for the concrete piers and abutments of a single-track railway bridge about fifteen hundred (1,500) feet long, consisting of fifteen (15) deck, plate-girder spans. Bed of stream is solid rock that will not have to be cut into more than a foot to obtain a satisfactory foundation.

Abutments and
Piers

The stream is practically dry for six (6) consecutive months of the year, and the construction is to be done during the dry season. The surface of the bed-rock is almost horizontal over the entire crossing. Distance from grade to bed-rock is about sixty (60) feet. No ice-breaks on piers will be required.

The structure is for a new line, hence it will not be necessary to figure on maintaining traffic.

There is a quarry of good rock for broken stone quite near the bridge site, and satisfactory sand can be had for the digging within three (3) miles. The nearest railroad station is about two (2) miles from the site. The location of the work is in western Texas. Bids are to be called for at schedule rates.

EXAMPLE NO. 8.

Masonry Piers

Prepare complete specifications for stone masonry piers with concrete backing for the same crossing, taking the stone from the same quarry as before. Masonry to be first class. Foundation pits to be leveled off with concrete. Bids are to be called for at schedule rates.

EXAMPLE NO. 9.

Railroad Bridge

Prepare complete specifications for the substructure of a single-track railroad bridge across the Papaloapam River in Mexico, consisting of two (2) concrete abutments resting on pile foundations (the tops of the piles being encased in the concrete), five (5) ordinary piers, and one pivot pier. The concrete shafts of the piers rest on timber cribs and caissons sunk by open dredging about fifty (50) feet below the bed of the river, which is about forty (40) feet below the grade line of structure. Width of river about eleven hundred (1,100) feet. A satisfactory mixture of clean sand and gravel can be dug from the river bed near the site and used for concrete as it is found, but the proper amount of cement for filling the voids must be determined often by measuring the latter.

The timber for the cribs and caissons must be imported from Louisiana or Texas. All materials will be delivered at bridge site free of charge for hauling over the railroad company's lines.

Seven (7) months from the date of signing the contract will be allowed for completing the work. Liquidated damages are to be one hundred dollars (\$100) gold per day. Bids are to be called for in American money as follows: Per cubic yard of mass of cribs and caissons in place. Per cubic yard of shafts of piers and of portions of abutments above low-water level as the latter is shown on the accompanying plans. Per cubic yard of those parts of the abutments below low-water level, including portions of piles encased in the concrete. Per lineal foot of piles in place projecting below the concrete in the abutment foundations.

EXAMPLE NO. 10.

Prepare the specifications for a reinforced-concrete arch highway bridge of one hundred and five (105) feet clear span and twenty (20) feet rise, resting on a solid rock foundation and springing from the rocky sides of a gorge above high-water mark, the clear width of roadway between parapet walls being thirty-four (34) feet. Assume that there is no special risk from floods during erection.

Reinforced-Concrete
Arch Bridge

Bids are to be per cubic yard of concrete and per pound of the reinforcing metal, also per cubic yard for excavation in both rock and earth.

EXAMPLE NO. 11.

Prepare the specifications for a main sewer of concrete, two and a half ($2\frac{1}{2}$) miles long and six (6) feet in diameter, for the city of Rochester, N. Y., and provide for the connections for lateral sewers, ventilators, man-holes, and all other details. Excavation is partly through earth and partly through rock. In one stretch of a quarter of a mile the foundation is so soft and wet as to require piling. Call for bids per lineal foot of finished sewer in accord with the plans and specifications which are on file in the City Engineer's Office.

Main Sewer

EXAMPLE NO. 12.

Prepare complete specifications for the manufacture and shipment of the metal-work for four (4) single-track, through, riveted-truss spans, each two hundred (200) feet long, measured between centers of pedestal pins, designed according to Class R. of Waddell's "Specifications for Steel Bridges," and weighing about 2,650 pounds per lineal foot of span. Point of delivery of metal is Beaumont, Texas.

R. R. Bridge

Time allowed for manufacture and delivery is four (4) months. Metal is medium steel. Four (4) sheets of drawings will be required.

EXAMPLE NO. 13.

Prepare complete specifications for the manufacture of a cylindrical steel water-tank, twenty (20) feet in diameter and sixteen (16) feet high, carried by a braced steel tower fifty (50) feet high, resting on concrete pedestals that are supported on earth foundations capable of withstanding a vertical load of four thousand (4,000) pounds per square foot.

Steel Water-Tank

Location alongside of a railroad in a small Missouri city.

Call for bids per pound of metal erected and painted and per cubic yard of concrete in place, no direct payment being made for excavation.

EXAMPLE NO. 14.

R. R. Trestle

Prepare complete specifications for a single-track railroad trestle to be built of long-leaf yellow pine timber, resting on cypress piles of best quality. Length of trestle about two thousand (2,000) feet, and average height from ground to grade about thirty-five (35) feet.

Piles to be creosoted and timber to be painted with Carbolineum.

Call for bids for timber in place, painted, per M. ft. B. M., creosoted piles left in place per lineal foot of pile, cut-off ends of same per lineal foot, iron in place per pound, and laying rails per lineal foot of track, the rails being furnished by the railroad company.

EXAMPLE NO. 15.

Concrete Dam

Prepare complete specifications for a curved concrete dam sixty (60) feet high and seven hundred and twenty (720) feet long, located at a narrow part of a rocky gorge, near Boulder, Colo. Bottom and sides of the cañon are of solid rock. Large quantities of water pass in the wet season, but there is practically none passing in the dry season, which is usually of seven (7) months' duration. Plenty of good stone and sand for concrete are to be found near the site, but the cement will have to be transported by wagon thirty-five (35) miles from the nearest railroad station. Provide for a temporary dam of timber and clay to hold back the small amount of water passing in the dry season, in order that the footing of the concrete dam may be built in the dry.

EXAMPLE NO. 16.

Railroad

Prepare specifications for the building of a railway, complete in every particular (excepting only the bridges, buildings, and rolling-stock), one hundred and twenty (120) miles long, located in the State of Washington. The contract is to be let at schedule prices for everything, and the entire work is to be completed and turned over to the Company within twelve (12) months.

EXAMPLE NO. 17.

Timber Pier

Prepare complete specifications for a pier to be built of creosoted timber and piles in Galveston Bay. Length, six hundred and forty (640) feet, width sixty-four (64) feet, and height eighteen (18) feet above extreme low-water level.

The construction to be of the most substantial character, and the piling to be thoroughly sway-braced. Deck to be built of six- (6) inch planks. Structure to carry two railway tracks at middle over its whole length.

Live load 350 pounds per square foot of floor.

EXAMPLE NO. 18.

Prepare complete specifications for a deck, plate-girder turn- Turntable
table on a concrete foundation and having the pit-wall also of concrete. Capacity must be great enough to take care of the longest and heaviest locomotives ever built. To be operated by electricity.

N. B.—The specifications need not cover the operating machinery, except in a merely descriptive manner.

EXAMPLE NO. 19.

The metal-work for two (2) through, riveted spans of one hundred and twenty (120) feet each and for three (3) deck, plate- Cleaning and Re-
girder spans of forty (40) feet each was dropped overboard by the painting
capsizing of a barge in the harbor of Vera Cruz, Mexico, and was afterward raised, taken ashore, and piled. The result was that it rusted very badly and had to be thoroughly cleaned by sand-blast, etc., and repainted before being shipped to bridge site.

Prepare the specifications for cleaning and repainting the said metal-work.

EXAMPLE NO. 20.

Prepare complete specifications for building a brick chimney two Brick Chimney
hundred and fifty (250) feet high for the Orford Copper Company on Staten Island, N. Y.

The contract to be let for a lump sum. Foundation is hard clay.

EXAMPLE NO. 21.

Prepare complete specifications for building a brick well fifty Well
(50) feet in diameter and forty (40) feet deep, resting on a steel curb and sunk through sand to obtain a water-supply. Contract to be let for a lump sum.

EXAMPLE NO. 22.

Prepare complete specifications for building two parallel rock- Rock Jetties
jetties, each about half a mile long, at Brazos de Santiago, Texas, so as to obtain a channel having a minimum depth of fourteen (14) feet, the distance apart of the jetties being about five hundred (500) feet. The work is to be done by contract with the United States Government.

Bids are to be made per lineal foot of jetty for heights measured from base to top, varying by one foot, from a minimum of six (6) feet, to a maximum of twenty-four (24) feet.

EXAMPLE NO. 23.

Dyke

Prepare the specifications for a trailing, wattled-pile dyke, three-quarters of a mile long, with wattled cross-dykes at intervals of about three hundred (300) feet, to be built along the bank of the Missouri River at East Omaha, Neb., mainly for the purpose of stopping the river's encroachment, but incidentally also for making land so as to increase the holdings of the East Omaha Land Company. The front of the trailing dyke is to be protected against scour by a woven willow mattress sixty (60) feet wide and as long as the dyke, the piles of the latter being driven through the mattress near the shore edge.

Bids are to be made per lineal foot of pile in place, per M. ft. B. M. of timber in place, per pound of iron in place, and per square foot of mattress complete in place, including the anchorage stones.

EXAMPLE NO. 24.

Settling Basins

Prepare complete specifications for four (4) settling basins to be constructed for the purpose of purifying the water supply of Richmond, Va., and to provide for the needs of a city of 125,000 inhabitants.

Bid to be called for by a lump sum.

EXAMPLE NO. 25.

Asphalt Paving

Prepare complete specifications for paving with asphalt a street in Baltimore four thousand eight hundred and fifty (4,850) feet long and forty-four (44) feet wide between curb lines. Entire construction to be of the very best. Tenders to be made per square yard of finished pavement.

EXAMPLE NO. 26.

Wood-Block Paving

Prepare similar specifications for the same contract, but using creosoted yellow pine blocks instead of asphalt.

EXAMPLE NO. 27.

Excavation

The earth has been excavated to the full depth of the foundations for a large building in Chicago, and the bearing capacity of the soil is to be tested at a number of points distributed with some uniformity over the whole area. A special apparatus is to be designed for loading with pig-iron.

The work is to be paid for at actual cash cost, plus a percentage thereof for profit to be named by each bidder tendering, the one

naming the lowest percentage to receive the award of the contract, only responsible parties being permitted to compete. Prepare the necessary specifications.

EXAMPLE NO. 28.

Prepare complete specifications for building three and one-quarter ($3\frac{1}{4}$) miles of double track for an electric railway on the paved streets of the city of Chicago, including the furnishing and placing of stone-block pavement on the space between the two outer rails and on two (2) feet outside thereof. Rails to weigh ninety (90) pounds per yard, and ties to be of creosoted, long-leaf, yellow pine.

Electric Railway
Track

Bids are to be made per lineal foot of double track. Describe carefully in detail the style of track and pavement.

EXAMPLE NO. 29.

Prepare specifications for the metal-work of a large, steel-skeleton building to be erected in New York City. It will be permissible when treating of character of metal and metal-work to refer clause by clause to well-known standard specifications for manufacture of steel and of steel structures.

Steel Building

Assume the various leading dimensions of the building and describe in detail the design of the metal-work.

Bids are to be by the pound of metal erected and painted.

EXAMPLE NO. 30.

The new five hundred and twenty (520)-foot swing span of the East Omaha bridge over the Missouri River has located in its tower a small power-house, absolutely fireproof, to contain a portion of the electrical machinery. The construction is of steel and concrete.

Swingbridge

Draft the specifications for such a house.

EXAMPLE NO. 31.

Prepare complete specifications for a through train-shed to be built on the reclaimed lands at the north end of Kansas City, Mo., the length being nine hundred (900) feet and the width two hundred and eighty (280) feet. Use tin roof of best quality, wooden louvres, skylights of wired glass, copper gutters and down-spouts, and all other details of the very best kinds employed in similar structures. The trusses are to be of the cantilever type, each resting on two columns that must act also as beams to resist the wind pressure. There are to be no side walls, excepting that at the south side of the shed the north wall of the depot building will serve as such. The foundations are to be large concrete pedestals resting on piles

Train-Shed

of concrete or creosoted timber driven to whatever depths may be found necessary.

EXAMPLE NO. 32.

Roundhouse

Prepare complete specifications for a brick roundhouse to accommodate twelve (12) locomotives. Foundations to be of concrete resting on hard clay.

EXAMPLE NO. 33.

Sea Buoy

Prepare complete specifications for a large sea-buoy to be built of steel, including the necessary cable and anchor or anchors. In respect to character and quality of materials and workmanship it will be permissible to refer to standard clauses of well-known specifications for steel construction. The item of water-tightness should receive special consideration.

EXAMPLE NO. 34.

Floating Foundation

Prepare complete specifications for a floating foundation of steel and concrete for a large eight (8)-story hotel building for the city of New Orleans, designed according to the author's method as given in his paper upon "Foundations for Important Buildings in the City of Mexico," which paper is included in Mr. John Lyle Harrington's book, entitled "The Principal Professional Papers of Dr. J. A. L. Waddell, Civil Engineer."

As in other cases it will be permissible to refer to certain standard clauses concerning materials and workmanship for the steel as given in well-known specifications.

EXAMPLE NO. 35.

Bridges

Referring to Case No. 3 in the appended examples for contract writing, prepare the specifications therein mentioned for the erection of the four spans.

EXAMPLE NO. 36.

Ocean Pier

Referring to Cases Nos. 8 and 9 in the appended examples for contract writing, prepare the specifications therein mentioned for building the Ocean Pier.

EXAMPLE NO. 37.

Steel Lighthouse

Prepare complete specifications for a steel lighthouse supported on screw-piles to be erected on the coast of Texas, the total height being one hundred and five (105) feet above low water, and the floor of the living rooms being placed at an elevation of twenty-five feet above same. The specifications for the lantern itself may be omitted, excepting that its size and character should be described. The foundations for the structure are solely sand. Bids are to be by lump sum.

EXAMPLE NO. 38.

Prepare complete specifications for the erection by flotation at Bridge Boca del Rio (which is some fifteen (15) miles south of Vera Cruz, Mexico) of eight single-track railroad, deck, plate-girder spans, the piers and abutments for which are in place. As the rise and fall of tide there are small and slow, it will be necessary to figure on letting water into the barges in order quickly to bring the spans to rest on the bridge seats.

Bids are to be per pound of steel erected (the metal being furnished by the railroad company), per M. ft. B. M. of timber furnished and put in place by the contractor, and per lineal foot of track for laying the rails, which are to be provided by the company.

EXAMPLE NO. 39.

Prepare complete specifications for a steel tower somewhat Tower similar to the Eiffel Tower in Paris, a quarter of a mile high and having a base four hundred and forty (440) feet square between centers of main pedestals, to be constructed in the city of Chicago, Ill.

Foundations of the concrete pedestals to be piling of concrete or creosoted timber. Buildings of various kinds are to be placed at different heights in the tower, and near the top there is to be a dancing pavilion.

The Author once made a design for such a tower, but prepared no specifications. He would be pleased to furnish copies of the drawings to any student who desires to undertake the drafting of specifications for this "Example." However, he does not advise many of them to try it, as the said specifications would have to be long and complex, although portions of them, such as those for the elevators and buildings might be omitted.

EXAMPLE NO. 40.

Prepare complete specifications for the viaduct referred to in Viaduct Cases Nos. 1 and 2 of the appended examples for contract writing. The total length of the structure is about twenty-five hundred and fifty (2,550) feet, its greatest height about ninety-five (95) feet, the width of main roadway thirty-four (34) feet, and that of each of the two sidewalks four and one-half (4.5) feet. The structure is to occupy city property only, being located entirely on Marshall street.

The student will have to assume the quantities of the various materials on which he is to call for bids, as these have not yet been computed.

Engineering Contracts.

A Lecture to Civil Engineering Students,
Delivered in 1905.

Introduction

YOUNG GENTLEMEN—Some two years ago I delivered to the Senior Class of the Rensselaer Polytechnic Institute a lecture on the subject of "Specifications," and in it I touched but lightly on that of "Contracts," merely quoting from the standard form of contract of my firm certain clauses that were needed to make my discourse complete. Engineering contracts, however, are of such importance to the profession as to be worthy of a special lecture devoted to their discussion, and this I purpose giving you to-day. The fact that the subject is treated very thoroughly in several standard works might at first thought lead one to believe that a lecture on it is superfluous, but such is not the case, because what I have to say is in a sense supplementary to that which is found in the books. Moreover, by discussing it from the strictly practical point of view, and thus making it more interesting than a study of law-books, which, as you all know, are notoriously dry reading, I hope so to present the matter that it will appeal directly to engineering students.

Sequel to Specifications

In one sense this lecture is a sequel to that on "Specifications," and will be appreciated better by those who have read the latter; nevertheless, I shall endeavor to make the treatment of the new subject complete in itself and independent of the preceding lecture. The general plan, however, is the same for both—viz., a dissertation concerning the theory or science of writing, followed by illustrations taken from actual practice.

Contracts and Specifications Distinguished

The dividing line between specifications and contracts is most difficult to draw, for in any particular case two engineers will rarely agree as to what clauses pertain properly to the specifications and what to the contract, of which the specifications form a part. Some engineers prefer to throw nearly everything into the specifications and thus keep the size of the contract proper as small as possible,¹

¹ Not so much to make the contract *small*, as to make it *general* and applicable to many cases or structures.

while others make the latter very extensive by including in it many clauses that are ordinarily found in the specifications. Again, others make a practice of repeating in the contract certain clauses that have already been covered in the specifications. In my opinion, the last-mentioned method is open to criticism in that it is liable to result in conflicting clauses; nevertheless, it is quite possible that my practice has not invariably been entirely free from this objectionable feature—it is so hard to be always consistent; and again, one's methods are a matter of development and are not created perfect at one essay.

Before proceeding to the direct treatment of my subject I shall endeavor to make clear to you the method that I have adopted for locating the dividing line between specifications and contracts. I say "endeavor" advisedly, for I am not sure that I can always give a satisfactory rule or reason for any particular division; because absolute consistency is an attribute that, strive as one will to attain it, lies ever just beyond reach.¹

My preference is to throw as much of the matter as possible into the specifications and reduce the size of the contract proper to a minimum, avoiding repetition of statement in the two parts of the work, but of necessity treating certain subjects in both parts, though from different points of view. There is no doubt about the proper place for most of the topics or headings, but in certain cases there are plausible reasons for locating them in either division. All clauses that relate to methods of construction, qualities of materials, character of the work, rules limiting the functions and powers of the Contractor and defining the authority of the Engineer, directions to bidders, and transportation of men and materials unquestionably belong to the specifications; but such clauses as those relative to adherence to specifications, alteration of plans, damages, extras, payments, responsibility for accidents, the spirit of the specifications, strictness of inspection, liquidated damages, scope of the contract, and time of completion might perhaps be properly inserted in either division. My custom, however, is to include all of these clauses and others of like character and scope in the specifications.

Nine out of ten of the contracts that an engineer has to prepare are in connection with construction, and an intelligent specialist

¹ It is considered excellent practice to limit the general covenants and obligations to the contract and to include in the specifications matters which are special to the particular structure in hand, and which are matters of engineering and architectural construction.

soon learns how to prepare satisfactory specifications and contracts for all ordinary kinds of work; but this style of contract is by no means the only type with which an engineer is concerned, for he is sometimes called upon to draft agreements between promoters of enterprises and capitalists, between himself and promoters of enterprises, between two engineers, between two contractors, or between a surety company and a contractor. Some of these unusual types are exceedingly difficult to draft properly, as, owing to their varying conditions, they cannot be systematized. It is mainly with them, therefore, that this lecture on contract writing is concerned, because for construction in general it is practicable to evolve a form which, when correctly filled out, will apply to any ordinary case.

Contract Writing a
Science

The importance of drafting contracts properly cannot well be overestimated. An incorrectly drawn agreement is almost certain to involve serious trouble and often pecuniary loss to an innocent party; hence it behooves engineers to study thoroughly and fundamentally the science or art of contract writing.

Whether it be really a science or an art is a mooted point; but, in my opinion, the writing of proper specifications and contracts is certainly worthy to be termed a science.

Desiderata

Before one can draft a contract, he must have clearly in mind a full and well-defined idea of all the conditions and *desiderata*, and he should epitomize these systematically before beginning to write. It is advisable to keep constantly in view the possibility that each party to the contract may be unscrupulous and willing to take every possible advantage of every weakness which the contract may contain and which will tend to his own profit—honor and integrity to the contrary notwithstanding. Failure to do this will often result in some ambiguity that will cause rank injustice to one of the parties to the agreement. It is difficult for an engineer to recognize this weakness of human nature and to bear it steadily in mind when writing contracts, because the training and the work of engineers tend to develop in them to an eminent degree the principles of absolute honesty; consequently, it comes hard for them to be forced to make a practice of doubting the integrity of their business associates. To mistrust the motives of one's fellow-men is disagreeable but essential, if the writer of specifications and contracts is to protect himself or his clients from loss and fraud.

Misplaced Confidence

Concerning this matter I speak from sad experience, for in my business career I have at times suffered severely from the ill-effects of a too-trusting reliance upon the honorable intentions of those with

whom I have done business; and, while this unfortunate experience, I am happy to say, has not caused me to mistrust the goodness of human nature in general, it has taught me the necessity for exercising the utmost caution in drawing contracts, so as not to put temptation in the way of either party by inserting a single clause of which he could take advantage by compelling the other party to do something that was not contemplated when the agreement was made. Occasionally it happens that after a contract is executed, one of the parties finds a flaw that will give him an improper advantage; and it is only a strictly just and upright man who will refuse to avail himself of such a weakness in the document.

The essential elements of any contract, according to Mr. John Cassan Wait, the noted authority on "Engineering and Architectural Jurisprudence," are as follows: Essential Elements

"1st. Two parties with capacity to contract.

"2d. A lawful consideration—a something in exchange for its legal equivalent, a *quid pro quo*.

"3d. A lawful subject-matter, whether it be a promise, an act, or a material object.

"4th. Mutuality—a mutual assent, a mutual understanding, a meeting of the minds of the parties."

Without these four elements no contract is binding in law.

The essentials of a well-drawn contract that comes within the province of the engineer, however, are as follows: Engineering Essentials

1st. A proper and customary form.

2d. A full and correct description of all parties to the agreement.

3d. A thorough and complete preamble.

4th. A statement of when and under what conditions the contract is to become operative.

5th. The limit, if any, for duration of contract.

6th. An exhaustive statement of what each party to the contract binds himself, his executors, administrators, successors, or assigns to do or to refrain from doing.

7th. A clearly defined enunciation of the consideration which each party is to receive; this is the essential *raison d'être* of the instrument.

8th. The forecasting of all possible eventualities that would materially affect the agreement, and a full statement of everything that is to be done in case of each eventuality.

9th. Penalties for failure to comply with the various terms of the agreement.

10th. Provision for possible cancellation of contract.

11th. Provision for settlement of all business relations covered by the contract or resulting therefrom in case of cancellation, taking into account all possible important eventualities.

12th. Mention of the place where the agreement is drawn or of the place where it is to be put in force, so as to show the state under the laws of which the validity of the contract is to be determined, should suit be necessary to enforce it.

13th. Methods of payments, if any are to be made.

14th. Provision for extra compensation and the limitations connected therewith.

15th. Provision for possible changes in contract.

16th. Provision for transfer of the contract or for subletting.

17th. Provision for settlement of disputes.

18th. Provision for satisfactory and sufficient bond, if any be needed.

19th. Provision for defense of lawsuits, if such provision be necessary.

20th. Definition of names used in contract, such as "Engineer," "Company," "Contractor," or "Trustee."

21st. Dating of contract.

22d. Proper signatures with the necessary seals, if the latter be required.

23d. Witnesses to the signatures, or execution before a notary public.

Contract Forms

I shall now take up and discuss in the order of their enumeration each of these essentials to a properly drawn contract.

1st. The styles of opening clause for contracts are both numerous and varied, and it is difficult to say which is the best. Each writer naturally will have one favorite style and will adhere to it whenever possible. Mine for many years has been as follows: (In order to make it more readable I shall fill out the spaces with some assumed names and a date.)

Introduction

"MEMORANDUM OF AGREEMENT, made and signed this eleventh day of February, 1905, by and between the Kansas City Bridge and Terminal Railway Company, a corporation of the State of Missouri, the party of the first part, and sometimes termed in this agreement and in the specifications the "Company," and The Western Contracting Company, a corporation of the State of Kansas, the

party of the second part, and sometimes termed in this agreement and in the specifications the 'Contractor.' "

Wait recommends the two following forms of introduction:

"This agreement, made and entered into this eleventh day of February, in the year of 1905, by and between, etc., etc."

"Articles of Agreement, made and entered into between The Kansas City Bridge and Terminal Railway Company, a corporation, etc., etc., and The Western Contracting Company, a corporation, etc., etc., on this eleventh day of February, 1905."

After the introductory clause comes the preamble, and immediately after it I insert in capital letters "NOW THIS AGREEMENT WITNESSETH," and follow with consecutively numbered clauses that embody all the terms and conditions of the contract, then close with provision for the signatures and seals of the contracting parties and witnesses to these signatures. Attestation

2d. In describing the various parties to an agreement care should be taken to make the description full and convincing in order that there shall be no possible mistake concerning the identity of each party. This is effected in the case of an individual by stating his occupation and place of residence, in the case of a firm by naming it fully, mentioning its place of business, and describing the kind of partnership, and in case of a company by giving its legal title and the name of the state or country where it was incorporated. In case of a partnership it is sometimes well to specify whether it is general or special in respect to the work covered in the contract. Parties Described

While most contracts are drawn between but two parties, it sometimes occurs that an agreement will involve three or even more. Such a contract is much more complicated and difficult to draft than one between two parties only. Number of Parties

Each party should be designated in the instrument by his special number, as the party of the first part or the party of the second part; and in addition it is well to give each another designation, such as "Contractor," "Company," "Owner," "Engineer," "Promoter," "Board," "City," "Incorporator," or "Trustee" in order to avoid the use of too many words throughout the document, as would be the case were he always referred to as the party of the first or second part. In order to make assurance doubly sure it is well in some cases to define the terms "Contractor," "Company," "Engineer," "Promoter," etc., at the end as well as at the beginning of the document. In any case these explanatory clauses should be placed at Persona Descriptio

the beginning or the end of the specifications, because the latter are often used without the contract being attached.

Precedence

There is no strict rule as to the order in which the several parties shall be placed, but it is customary to make the one who pays the money the party of the first part. In case of employer and employee the employer should come first. In other cases it is a good rule to put the most important party first and the others as nearly as may be in the order of the importance of their relation to the enterprise or object matter of the agreement.

Authority

There is a consideration of primary importance in contract writing that is sometimes overlooked—viz., whether the parties to the agreement are legally entitled to enter into contract. For instance, in the case of a company, the president or general manager, or perhaps either, can sometimes legally contract in the company's name, but sometimes he cannot, in which case, if haste be essential, it would be proper to have him enter into and sign the contract and afterward have it formally approved at a meeting of the board of directors. A properly certified copy of the board's approval should subsequently be attached to the contract. Access to its charter and by-laws is generally necessary to determine who has authority to enter into and sign contracts for a company.

Ultra Vires

In contracting no corporation can exceed the limit of its powers as given by its charter. If it attempts to do so, its act will be *ultra vires* and without effect; consequently it behooves one in writing a contract with a corporation first to study well its charter, articles of incorporation, and by-laws.

Membership Organization

Contracting with unincorporated organizations as parties, such as associations, clubs, societies, or congregations, is a precarious business; nevertheless, it often has to be done. In order to insure the payment of money obligations by such parties a sufficient sum should be deposited in advance in the hands of a reputable trustee with instructions to pay it to the proper party or parties as soon as the obligations covered in the contract have been met; otherwise the other contracting party is liable to lose his entire consideration, because it is very difficult to hold legally an organization that has no legal existence, even if all the members thereof be individually liable. Here again I speak from sad experience, for at the outset of my consulting practice I lost what I considered then a large fee by dealing with a committee of public-spirited citizens, who were not honest enough to pay their just debts after the proposed enterprise had failed. Even the law did not enable me to collect the bill, as

my lawyers did not present the case to the court in the proper manner.

Again, any person under twenty-one years of age, termed in law Infants an infant, who enters into a contract, has the privilege of repudiating it after arriving at the age of maturity, in case that it does not redound to his advantage; consequently it behooves the writer of a contract to make sure in all doubtful cases that the contracting parties are of age. In engineering contracts, however, this question is seldom likely to arise, because very young men are not often concerned in a prominent way with important enterprises.

Similarly, imbeciles, inebriates, and lunatics are incompetent, Parties Incompetent and contracts made by them are legally voidable at their option. While it is highly improbable that either an imbecile or a lunatic would ever be made a party to an engineering contract, it is not impossible that a man chronically addicted to the overuse of liquor might be so concerned. Such a man might plead that he was under the influence of drink when he signed the document and thus possibly effect his release from its obligations; consequently the writer of an engineering contract should assure himself of the temperate character or at least of the sober condition of the parties thereto.

A married woman in some states cannot contract, sue, or be Married Woman sued in her own name. While it is uncommon for women to be engaged in enterprises involving engineering, it is by no means impossible, as I have learned from a hard lesson; for in the case of a contract for the engineering of a large and novel enterprise that I entered into with a certain man, it transpired that he was acting as agent for a married woman. Before our work was finished the man died, and the woman gave us notice in writing that she would assume his share of the contract, and instructed us to finish our work. This we did, and she paid us one-half of our total fee; but before the date specified in the contract for the payment of the second half, the bottom dropped out of the scheme, and the lady then refused to make any further payment. She did not plead her married state as a justification for her refusal, but we knew what we might expect in a legal contest over the question, consequently we entered the balance on the wrong side of our ledger in the "Profit and Loss" account.

In case of war a contract entered into between parties who War are subjects or citizens of the conflicting countries is illegal, and if war be declared subsequent to the signing of the contract, its obligations cannot be enforced by law until after the war has ceased.

As engineers are often interested in projects in foreign countries, this is a matter that needs to be borne in mind when preparing the contracts for such enterprises.

Agency

When a contract is entered into by an agent, care should be taken to make this relationship both clear and legal in the document by stating the name of the owner or corporation and following it with the words "acting by and through Mr. X, Agent, Attorney, Engineer, President, or Treasurer (as the case may be), by virtue of the authority vested in him through power of attorney of the (here name the individual or company) dated the —— day of —— 19——, a copy of which is hereto annexed," or in some similar and equally explicit manner. In this way the name of the real principal is made certain, the authority of the agent is preserved, and the possible liability of the agent as the principal is averted. It must be remembered that no claims or obligations against a principal are created by a contract entered into by an agent who acts without proper authority, unless the contract be afterward confirmed directly or indirectly by the principal.

Government as
Party

Much engineering work is being done and is to be done in the future by contract with the United States Government. In making such contracts it is important to note that although the Government may enter suit on its contracts for their enforcement, it cannot, without its own consent, be sued for non-compliance therewith. Instances are not unknown of repudiation of contracts by governments. Furthermore, public officers cannot be held personally liable for contracts signed by them in their official capacity.

Execution

The names of the parties in the body of a contract should correspond exactly with the signatures and seals at the end, for a variation might prove fatal to the validity of the document.

Preamble

3d. The preamble is a most important portion of any contract. It should explain fully all the whys and wherefores of the agreement and its *raison d'être*. A thorough explanation of these would often render clear the intent of a clause in the body of the instrument that is otherwise ambiguous.

Once more I am speaking from experience, for in an important but hurriedly prepared contract one of the clauses was not drawn with sufficient clearness, and, in consequence, one of the parties to the agreement tried to take an unfair advantage of it. Had the preamble explained carefully and in detail the ultimate object of the contract and the various steps necessary for its accom-

plishment, the said party would not have been able to make the claim he did.

You will be better able to judge of the importance of the preamble and to understand its scope after hearing read the specimen contracts that are to conclude this lecture.

4th. Every contract should contain a statement of when or under what conditions it is to become operative. The date may be some particular day of month and year or immediately after, or some definite time subsequent to, some act or occurrence, such, for instance, as the giving of written notice, or the deposit of a certain amount of money in a certain place, or the completion of a certain piece of work, or the arrival of a railroad at a certain point. Whatever the "condition precedent" may be, it should be made clear in the document beyond the peradventure of a doubt. Conditions Precedent

5th. Too often in contracts nothing is said concerning the duration of the agreement or of how it is to be drawn to a close. In some cases it would be impracticable thus to limit the life of the contract; but in others it is not only practicable, but also advisable, and sometimes it is imperative, especially where a bond for proper completion of work is involved. Duration

6th. The statement of what each party to the contract binds himself, his executors, administrators, successors, or assigns, as the case may be, to do or to refrain from doing, should be thorough and complete in every detail. The importance of this is self-evident, nevertheless it is a point that is not always given proper attention in contract writing. Legal Representatives

In all contracts between corporations or between a corporation and an individual, the promises to perform should be made binding upon the successors or assigns of each corporation, although it is probable that the law would enforce this even if the stipulation were omitted.

In contracts where an individual is a party to the agreement it is best to bind not only himself, but also his executors or assigns, unless, perchance, the obligation be of such a nature as to be non-transferable, as for instance, the performance of personal duties or services of an expert nature or involving special skill. Thus an engineer's services are not transferable, unless some special provision be made and agreed to by both parties that, in case of his death or inability for good and sufficient reason to finish his work, his contract is to be assumed by some other engineer, either named or to be determined afterward in some specific way. But the death Contracts for Personal Service

of one member of a firm of engineers will not cancel an agreement; for as long as one of the original members of the firm remains in charge the contract will hold. In other words, it would require the death or incapacity of all the original members of the firm to abrogate the contract, unless special provision to the contrary exist in the written agreement.

Construction contracts are generally assignable, unless they contain provision to the contrary.

Consideration

7th. The consideration which each party to an agreement is to give and is to receive should be clearly and fully stated in the document, otherwise unsealed contracts are liable to be held valueless and void in law. Moreover, the consideration must be real, substantial, and adequate. Some lawyers make a practice in many cases of specifying a consideration of one dollar, and they even try to pass that dollar around among the several parties to the agreement by having each party make nominally that payment to each of the other parties so as to show that each receives a valuable (?) consideration. In my opinion, such a practice is mere humbug and unworthy of adoption by any man pretending to scientific attainments in his profession, no matter whether that profession be law or engineering. Its adoption, it seems to me, is *prima facie* evidence of weakness in the document and a confession by its writer that he has failed to make evident the true consideration that each party is to receive and the real reason for each party's entering into the agreement.

Consideration Inadequate

There may be some excuse for passing the dollar in case of a parent deeding property to his child, where the true consideration is love and affection; but a dollar does not constitute a real consideration—it would be insufficient usually to pay the cost of type-writing the document; hence its employment is a fiction and a farce.

Eventualities

8th. No portion of the work of contract writing requires greater experience and ability than the forecasting of all possible eventualities that would materially affect the agreement and the proper provision for what is to be done in the case of each eventuality. All contracts are more or less faulty in this particular, for it would require omniscience to forecast all future happenings; nevertheless, in preparing an important contract one should endeavor to foresee and provide for all possibilities and probabilities. The lawyer or engineer who makes a practice of giving this important matter full consideration in every contract that he writes will soon find himself in demand by capitalists to aid them in making their investments

and in consummating their enterprises. The succeeding examples of contracts will illustrate what I mean by the forecasting of eventualities and providing for them.

9th. The matter of penalties is one that has to be handled with gloves, for the law is very jealous of its rights and prerogatives, and deems that it alone is authorized to specify and enforce a penalty, which it interprets as a punishment for failure to perform or comply with the terms of an agreement. On this account it is better not to use the term "penalty" in any contract, but to employ instead that of "liquidated damages." In my practice I have a clause in construction specifications that reads as follows:

"For each day of delay beyond the date set in the contract for completing the entire work herein outlined, all in accordance with the plans, specifications, and directions of the Engineer, the Company shall withhold permanently from the Contractor's total compensation the sum of ——— dollars; and the amount thus withheld shall not be considered as a penalty, but as liquidated damages, fixed and agreed to in advance by the contracting parties as a proper compensation to the Company for the loss caused it by such delay."

Liquidated damages are but seldom enforced, owing mainly to the characteristic good nature of engineers,¹ for they object to taking advantage of a contractor who has worked faithfully but has been unfortunate. Again, the fact that the sympathy of jurors is generally with the workingman and against corporations is a reason why disputes involving the retention of money to compensate for delays are generally settled out of court.

10th and 11th. In most contracts for construction and in some other types of contract there is no need to provide for a possible abrogation of the agreement, because the completion of the work involved is a natural cancellation; but in some other types, such, for instance, as partnership contracts that continue indefinitely, full detailed provision should be made for annulment at any time. Great care should be exercised to describe fully how all current business matters are to be closed and what compensation is to be paid to the other party or parties by the party who desires the said cancellation. To do this in a satisfactory manner will require business knowledge and ability of the highest order.

12th. It is quite important in many contracts to state where the instrument was executed and where it is to be put in force, notwithstanding the fact that the residence of each party in case

¹ And the aversion of courts and juries to their enforcement.

of individuals or the state of organization in case of corporations has been described in the introductory clause of the document. The laws governing a contract may be determined by the place where the contract was made or by that in which it is performed. Wait treats this question very thoroughly on pages 49 to 51 of his *Engineering and Architectural Jurisprudence*.

Payments

13th. Methods of making payments under construction contracts are generally covered in the specifications, where, in my opinion, they properly belong, although I have on several occasions been adversely criticized for not putting a payment clause in the contract proper. In all other types of contract in which payments of money are involved, full provision should be arranged for the exact manner in which all payments, both partial and final, are to be made. This remark applies with special force to contracts involving engineering fees; for in these, if payments on account are not arranged for, there is a chance that the engineers will receive no compensation at all until after the completion of their work, and this might be delayed for an indefinite period. Our usual practice is to ask one-half of our fee upon the completion of the plans and specifications and the other half in monthly payments proportionate to the amount of contract work done on the construction, so that when the latter is finished we shall have been paid in full. We have learned to provide also that we are to be compensated properly for all extra expense to us due to failure to complete the work in the time specified. It has cost us many thousands of dollars to learn this lesson, consequently the hint that I am giving you ought to be valuable.

Contracts for Professional Service

Extras to be Ordered in Writing.

14th. In construction contracts the subject of extra payments also belongs in the specifications, although in many cases it is covered in the contract proper. Our standard clause for this item reads thus:

"No extras will be allowed, unless they be ordered in writing by the Engineer. For extras so allowed the Contractor will be paid the actual cost to him, plus ten (10) per cent. for profit. Satisfactory vouchers will be required from the Contractor for all extra labor and materials."

Alterations

15th. It is a wise precaution to provide for making changes in every important contract. Our standard clause for this item is as follows:

"No change or alteration shall be made in the terms or conditions of this agreement without the consent of both parties hereto

in writing; and no claim shall be made or considered for any extra work, unless the same shall be authorized and directed in writing by the engineer."

16th. In construction contracts there should always be a clause to govern assigning the contract and subletting the work. Our standard clause for this reads thus: Subletting Forbid-
den

"The party of the second part hereby agrees that it will not assign or sublet the work covered in this contract, or any portion of it, without the written consent of the party of the first part, but will keep the same within its control."

17th. In respect to provision for settlement of disputes engineers are somewhat at variance. Some think that the engineer should be the sole arbiter, but I do not believe that such an arrangement is just, savoring, as it does, altogether too much of autocratic rule. I am a firm believer in arbitration for the settlement of all disputes on important matters, and it has for many years been my custom to provide in all construction contracts for such a method of settlement. Our standard clause for this matter is as follows: Engineer's Decision

"The decision of the Engineer shall control as to the interpretation of drawings and specifications during the execution of the work under them; but if either party shall consider itself aggrieved by any decision, it may require the dispute to be finally and conclusively settled by the decision of three arbitrators, the first to be appointed by the party of the first part, the second by the party of the second part, and the third by the two arbitrators thus chosen. In case that the two first chosen fail to agree upon a third, the latter shall be appointed by Arbitration
By the decision of these three arbitrators or that of a majority of them, both parties to this agreement shall be finally bound." The person chosen to appoint the third arbitrator should be some prominent official, such as the judge of a certain court, the mayor of a certain city, or the governor of a certain state.

It is seldom that an arbitration clause in a contract is utilized, because engineers as a rule are reasonable. Only once in my thirty years of practice has it been appealed to. The subject of dispute in that case was some lumber very properly rejected by my inspector as unfit for use. Unfortunately, the result of the arbitration was adverse to my decision, owing to a too friendly understanding between the officers of the Company and the Contractor.

Notwithstanding the fact that the contract reads that "By the decision of these three arbitrators, or by that of a majority of them, Appeal from Award

both parties to this agreement shall be finally bound," the law has decided that the losing party has still a right to appeal to the courts; consequently, this clause of our form of contract is not binding. Although I have known this for years, I have made no change in the clause, for the reason that at least nine contractors out of ten prefer arbitration to the delays, uncertainties, and expense that are inseparable from legal litigation, and I have never heard of a case in which the loser by arbitration appealed to the courts. It would simplify matters if immediately after an arbitration is agreed upon each party concerned were to give to the other a bond guaranteeing that he will abide by the decision of the arbitrators.

Bonds or Surety

18th. The bond question is a prominent feature of any construction contract and occasionally is important in other types of contract. My firm has finally come to the conclusion that a good Surety Company bond is the only kind that we shall either ask for or accept in future, for no other kind is so satisfactory to the Company or is obtained with so little difficulty by the Contractor. All personal bonds are obtained by favor and they are generally very unsatisfactory, for the solvency of the sureties is difficult to prove, and to enforce payment is still more difficult. Many years ago I had my first and last experience with a personal bond. It was when building my residence that I accepted from the contractor a joint bond signed by three or four persons, among them a good friend of mine. This bond was accepted by my lawyers; nevertheless, later on when the contractor threw up the work I found that the only responsible man on the paper was my friend. As I could not press him, I waived the matter, and in consequence was materially out of pocket.

Sureties Released

There is considerable humbug in connection with sureties to agreements, for a slight change in contract, plans, or specifications is often sufficient to render the bond null and void. If any one doubt this statement, let him read what Wait says on pages 13 to 17 of his *Engineering and Architectural Jurisprudence*. In my opinion the only way to protect the Company is to insist upon having a bond that will permit of all necessary changes in plans and specifications without releasing the surety, and even such a bond might be voided by the law's declaring it illegal because it departs from current practice.¹

Law and Equity

There are some very strange things about the law. On two or three occasions I have been provoked to make the statement that "laws are made to protect rogues against honest men," and truly it

¹ Decisions.

does seem sometimes as if such were the case. Law and equity are two entirely different things. The less that engineers have to do with the former and the more they employ the latter, the better it will be for all concerned.

In adjusting disputes I am a firm believer in the principle of compromise, or, to put it in more homely words, in that of "give and take." It is nearly always practicable to bring two disputing parties to terms by suggesting a reasonable compromise. Compromised Claims

19th. If, according to a contract, the Contractor is to indemnify the Company against all liability or damages on account of accidents, it is only fair that the former should be given the privilege of assuming the sole defense of all lawsuits arising from such claims. You will see later how our standard form of contract covers this point. Indemnity for Negligence

20th. The manner of defining by special clauses names used in the contract, such as "Engineer," "Company," etc., will be seen later in the various appended examples of contracts.

21st. A contract can be dated either in the opening or in the final clause, or in both. In the latter case it is better not to repeat the date, but to insert the sentence "Dated the day, month, and year first herein written." Contract Date

22d. It is important that the signatures coincide exactly with the names of the parties as given in the opening clause of the agreement, and that proper seals are attached when they are needed. If a party to a contract be a corporation, its corporate seal should be used, but in the case of an individual almost any kind of seal will suffice—either a wafer or the word "seal" with a scroll drawn around it with pen and ink being commonly used. In the latter case it is better to write in small letters the initials of the signer over the word "seal." Signature and Seal

Let me here call your attention to an important and fundamental difference between contracts with and without seals. The former do not need to have a consideration mentioned in them in order to make them valid, while the latter do require such mention. In former times there was far greater difference in the importance of sealed and parole (or unsealed) contracts than there is to-day; for then a sealed contract could not be modified without taking many formal legal steps, while to-day it can be changed quite readily by a short supplementary contract, provided there be a proper consideration mentioned therein for the making of the change. Specialties

23d. Where the party to a contract is a corporation, the proper witness to the Company's signature is the Secretary of the Company, Witnesses

who should use its corporate seal for attesting the document, but in case the party is an individual any witness will suffice.

Acknowledgments

The best possible witness to signatures is a properly authorized notary public, because if any doubt be expressed concerning the authenticity of the said signatures, all that is necessary is to prove the notary's authority, which is a matter of public record, while for all other witnesses it is obligatory to search for them and either produce them in person or prove that it is impracticable to do so on account of death or departure from the country; and in this case it is generally required that there be brought forward reliable parties who will swear that the witnesses' signatures are authentic.

Contract Form

In the hope that it may prove useful to you and to the readers of the volume that later on will contain this lecture, I herewith reproduce the standard "Form for Contract" of Waddell & Harrington for appending to construction specifications.

Introduction and Parties

MEMORANDUM OF AGREEMENT, Made and signed this day of 19, by and between the the party of the first part, and sometimes termed in this agreement and in the specifications the "Company," and the party of the second part, and sometimes termed in this agreement and in the specifications the "Contractor."

Preambles

WHEREAS,
.....
NOW THIS AGREEMENT WITNESSETH:

Undertaking and Consideration

First.—The party of the second part, for and in consideration of certain payments to be made to it as hereinafter specified, will
.....
all in accordance with the plans and specifications hereunto annexed and made a part hereof, and will fully finish and complete the same by, unless, in the opinion of the Engineer, the party of the second part be delayed or prevented by circumstances that are absolutely beyond its control.

Time of Essence

Second.—The party of the second part shall begin the work of construction as soon as practicable after the signing of the contract, and shall push the same to completion as rapidly as possible and within the time limit or limits set in the accompanying specifications.

Third.—All important dimensions and characteristics of the structures are fully described in the accompanying drawings and specifications, which form a part of this contract.

Fourth.—In consideration of the performance by the party of Undertaking the second part of its covenants and agreements, as hereinbefore set forth, the party of the first part hereby covenants and agrees to pay to the party of the second part as follows:

.....
.....
.....

In case that there be any other materials furnished by the Contractor that are not included in this list, they shall be paid for on the basis of actual cost to the Contractor plus ten (10) per cent. for his profit. Price of Extras

It is understood that no payments, either partial or final, are to be made for any material which is to be used for falsework or plant, but only for such material as is left permanently in the finished construction.

Fifth.—The schedule prices to be adopted in making partial payments for all work as it progresses are to be as follows: Schedule of Prices

.....
.....
.....

Sixth.—All material paid for by the party of the first part shall be deemed to have been delivered to, and to have become the property of the said first party, but the party of the second part hereby agrees to store it and to become responsible for it during the continuance of this agreement. If any of it be damaged, destroyed, or lost from any cause, including, among others, floods, washouts, and fires, the Contractor shall repair or replace the same at his own expense to the satisfaction of the Engineer. Title to Materials

Seventh.—In case the party of the first part, notwithstanding the failure of the party of the second part to complete its work within the time specified, shall permit the said second party to proceed, and continue, and complete the same, as if such time had not lapsed, such permission shall not be deemed a waiver in any respect, by the first party, of any forfeiture or liability for damages arising from such non-completion of said work within the time specified, and covered by the "Liquidated Damages" clause of the specifications; but such liability shall continue in full force Waiver

against the said second party, as if such permission had not been granted.

Written Order for
Extras

Eighth.—No change or alteration shall be made in the terms or conditions of this agreement without the consent of both parties hereto in writing, and no claim shall be made or considered for any extra work unless the same shall be authorized and directed in writing by the Engineer.

Delays

Ninth.—In the event of any delay in completing the work embraced in this contract, the party of the second part shall be entitled to no extra compensation on account of such delay, as it is hereby assumed that in submitting its tender it took its chances for the occurrence of such delay. If, however, in the opinion of the Engineer, the Contractor be delayed by any act of the Company to such an extent as to cause him serious hardship, such as a temporary cessation of the work, the Company shall allow the Contractor whatever compensation for such delay as may appear to the Engineer to be just and equitable.

Subletting

Tenth.—The party of the second part hereby agrees that it will not assign or sublet the work covered in this contract, or any portion of it, without the written consent of the party of the first part, but will keep the same within its control.

Engineer's Decision

Eleventh.—The decision of the Engineer shall control as to the interpretation of drawings and specifications during the execution of the work under them; but if either party shall consider itself aggrieved by any decision, it may require the dispute to be finally and conclusively settled by the decision of the three arbitrators, the first to be appointed by the party of the first part, the second by the party of the second part, and the third by the two arbitrators thus chosen. In case that the two first chosen fail to agree upon a third, the latter shall be appointed by
..... By the decision of these three arbitrators, or by that of a majority of them, both parties to this agreement shall be finally bound.

Negligence, Indem-
nity

Twelfth.—As, according to the terms of the accompanying specifications, which form a part of this contract, the party of the second part is to indemnify the party of the first part against all liability or damages on account of accidents occasioned by the omission or negligence of itself, its agents, or its workmen during the continuance of this agreement, and against all claims for royalties on patents; it is hereby agreed that the party of the second part shall be promptly and duly notified in writing by the

party of the first part of the bringing of any such suit or suits, and shall be given the privilege of assuming the sole defense thereof. The party of the second part is to pay all judgments recovered by reason of accidents or patents in any suit or suits against the party of the first part, including all legal costs, court expenses, and other like expenses.

Thirteenth.—The Contractor further agrees to give to the Com- Bond
pany a surety-company bond, satisfactory to the party of the first part in the sum of
for the faithful performance of this contract and the specifications, and of all the terms and conditions therein contained, and for the prompt payment for all materials and labor used in the manufacture and construction of the structures, and to protect and save harmless the Company from claims on patents and from all damages to persons or property, caused by the negligence or claim of negligence of the Contractor, his agents, servants, or employees in doing the work, or in connection therewith, and from injury to or loss of materials paid for by the Company either partially or in full before the completion and acceptance of the construction or constructions.

Fourteenth.—The word “Engineer” as used in this contract Parties Described
refers to the Consulting Engineers of the
.....
or their duly authorized representative.

IN WITNESS WHEREOF, the parties to this agreement have Execution
hereunto set their hands and seals.

Dated the day, month, and year first herein written.

WITNESSED BY

.....
.....
.....
.....

The ninth item of this form, as originally written without Extras and Delay
qualification, has been severely criticized on more than one occasion because of alleged unfairness. I refer to the clause which reads: “In the event of any delay in completing the work embraced in this contract, the party of the second part shall be entitled to no extra compensation on account of such delay; as it is hereby assumed that in submitting its tender it took its chances for the occurrence of such delay.” I admit the one-sidedness of this clause, and that if it were enforced to the letter by a narrow-minded or unfair engineer, it might effect a hardship upon the Contractor; neverthe-

less, as a matter of policy we still leave it in our construction contracts in order to prevent contractors from constantly making claims for extras on account of trivial delays; but, if a delay were of such importance as to necessitate a partial or total shutting down of the work, we would certainly see that the Contractor is compensated for the extra expense to which he is put by stopping and restarting construction, for in our dealings with contractors we aim always to act the part of "judge" and not that of partisan of the Company.

Cost plus Percentage

Once in a while it becomes necessary for a Company to let work on the basis of actual cost, plus a percentage for profit, and in this case special care has to be taken to cover all possible details and eventualities in order to protect the Company from extortion and needless expense. This manner of letting work is very favorable to the Contractor, but is troublesome and expensive for the Engineer and rather risky for the Company. Under certain conditions, however, it is the only way in which the work can be let at any reasonable figure, such conditions, for instance, as govern railroad or bridge building in a tropical country where fevers are prevalent and where the conditions affecting the cost of construction are practically unknown. My firm has acted as engineers on such work, and, consequently, we have learned by experience how contracts therefor should be prepared. The following is the type of contract that we would draft for such a case:

Example for Discussion

Let us assume that there is a railroad being built in the *tierra caliente* of Mexico from Matamoras on the American border through or near Tampico and Vera Cruz to the border of Guatemala, by an American company organized in West Virginia under the name of the Mexican Gulf Coastline Railway Company, and that it desires to let to the Central Bridge Company of Kansas City, Mo., the contract for building the substructures of all bridges and all the culverts on the line and for erecting all the superstructures, the metal for which is to be furnished and delivered at the bridge sites by the Company. Let us assume also that the basis of the contract is that the Contractor is to be paid the actual cost to him of the entire work, plus fifteen (15) per cent. for profit.

Under such conditions we would prepare specifications of our standard type, with possibly a few modifications, and would attach them to the following contract:

Parties

MEMORANDUM OF AGREEMENT, Made and signed this fourteenth day of March, 1905, by and between the Mexican Gulf Coastline Railway Company, a corporation of the State of West Virginia,

U. S. A., and having its principal business office in New York City, N. Y., the party of the first part, and sometimes termed in this agreement and in the specifications the "Company," and the Central Bridge Company, a corporation of the State of Missouri, U. S. A., and having headquarters at Kansas City, Mo., the party of the second part, and sometimes termed in this agreement and in the specifications the "Contractor."

WHEREAS, The party of the first part has already begun the construction of its road at several points along its line, which starts from the American border at Matamoras, Mexico, and parallels the Gulf coast, running near the cities of Tampico, Tuxpan, and Vera Cruz, and extending to the border of Guatemala, and

Preamble

WHEREAS, The party of the first part has already entered into contract with certain American firms for the manufacture of the metal-work for the superstructure of all the bridges required for its entire line, and

WHEREAS, The party of the first part desires to let to some reliable American contractor the contract for building all the bridge piers, abutments, and culverts and for erecting all the superstructures of bridges on the entire line of its road, and

WHEREAS, The party of the second part makes a specialty of building the substructures and superstructures of bridges, and has had a wide experience in this line of construction,

NOW THIS AGREEMENT WITNESSETH:

First.—The party of the second part, for and in consideration of certain payments to be made to it as hereinafter specified, will furnish all the materials for and construct complete all the bridge piers, abutments, and culverts, will erect and paint all the metal-work for the superstructures, and will furnish and put in place all the flooring for the bridges of the entire line of the said railway, all in accordance with the specifications hereunto annexed and made a part hereof, and with the plans and directions of the Engineer.

Subject-Matter

Second.—The party of the second part shall commence the work of construction as soon after the signing of the contract as it is practicable to begin, starting at as many different points along the line of the road as the Engineer may direct, and shall push the same to completion as rapidly as possible.

Commencement

Third.—In consideration of the performance by the party of the second part of its covenants and agreements, as hereinbefore set forth, the party of the first part hereby covenants and agrees, for itself, its successors, and assigns, to pay to the party of the second

Consideration.

part for the furnishing and completion of the entire work the actual cash cost thereof, plus fifteen (15) per cent. for profit.

Cost to Include

In computing the cost of the work, there shall be included all items of materials, labor, and transportation of men, materials, and plant to and fro, but no allowance will be made for cost of plant or deterioration of same, or for the time or personal expenses (other than railway and Pullman fares) of the party of the second part, or for interest on moneys required to carry on the work. Accident insurance for employees, insurance against loss of materials or plant by fire or shipwreck, and all stamps for documents, and taxes of all kinds shall be considered items of legitimate expense, and shall be allowed for by the Engineer in the monthly estimates, as shall also the cost of housing the workmen, but not their sustenance.

Plant

By the term "Plant" is meant all machinery and apparatus, new or second-hand, such as engines, dredges, diving apparatus, pile-drivers, wire rope used for tackle, blocks, forges, riveting apparatus, and blacksmith's tools that are of a permanent nature; but does not include such perishable materials as hemp rope, rubber hose, wheelbarrows, bolts, shovels, rubber boots, and all other tools and apparatus of a temporary nature. The decision of the Engineer shall control as to what is and what is not "Plant," and his decision shall be final.

Repairs

In respect to repairing plant and tools it is understood that all minor repairs that are done by the blacksmith and other employees of the Contractor are to be charged to the Company, as are also repairs during construction to the perishable parts of the plant and tools, such, for instance, as the timber for pile-drivers, the easily broken parts of riveting machinery, and pipes for boring outfit; but when the work of the Contractor is finished there will be no allowance made to him for the deterioration of his plant, nor will he be allowed to put it into thorough repair at the expense of the Company just before he completes the entire construction. When this completion occurs all plant is to be the property of the Contractor, and all other apparatus of any value and all surplus materials are to be delivered to the Company as per the directions of the latter. But the Company reserves the right to purchase from the Contractor any of his plant at its actual value where it was bought less a proper allowance for depreciation; and the Engineer is to be the sole arbiter concerning the actual value of such plant in case that the Company and the Contractor fail to agree thereon.

Sickness and Traveling Expenses

No sick or incapacitated employee shall be included on the

Contractor's pay-roll without the written consent of the Engineer in each and every case.

In respect to traveling expenses for employees, none shall be paid for the journey to the work until after the employee has been on the work for three (3) months; and no return expenses shall be allowed unless the employee has been discharged on account of no fault of his own, or until he has worked for the Company at least twelve (12) months. The traveling expenses allowed shall cover nothing but the railroad fare, except that in the case of the Contractors and their regularly salaried employees sleeping-car charges also shall be borne by the Company.

The men's time spent in traveling from the United States to Travel their work is to be paid for in case they remain three (3) months or more continuously thereon; otherwise there will be no allowance for time spent in traveling. In no case will any workman be allowed compensation for the time spent in returning home. No employee discharged for incompetency or misbehavior shall be allowed any return traveling expenses.

If during the progress of the work, in the opinion of the Delay Engineer, its prosecution is being delayed by reason of these restrictions concerning traveling expenses, the said restrictions may be modified or removed altogether by the mutual consent in writing of the two parties to this agreement, but in this manner only.

No material is to be paid for until after it is delivered at site, unless the Company shall have had it in its possession for over thirty (30) days.

Medical attendance and medicine at site will be paid for by the Medical Attendance Company; but no other medical or hospital expenses will be allowed, and the Company will bear all expenses connected with providing boiled and filtered or condensed water for drinking purposes.

The commissariat department shall be considered as a thing Commissary apart from this contract. The Contractor shall manage it at his own expense, and shall charge enough for board to reimburse himself for the entire outlay connected therewith and to provide a profit not exceeding fifteen (15) per cent. At the same time the Company shall insist that all employees be properly fed. The Company will make no charge for hauling commissariat supplies for the Contractor over its own lines. In respect to the proper feeding of employees and a reasonable price for board, the Engineer shall be the sole arbiter

in case that any dispute arise; and to this end the Contractor's commissariat books shall always be open to his inspection.

Exchange

In order to keep the accounts straight, all payments made in Mexico for labor and materials are to be in Mexican money, but the Engineer's monthly estimates are to be made in American money, the rate of exchange to be adopted in effecting the reduction being that ruling in the City of Mexico on the date of the Engineer's estimate.

Tools and Supplies

All bills for materials purchased outside of the Republic of Mexico, exceeding in amount five thousand dollars (\$5,000.00) in gold, after being approved by the Engineer, shall be sent directly to the Company for payment; but the Contractor shall receive his fifteen (15) per cent. profit upon them.

Tools and other supplies may be furnished the Contractor by the material department of the Company, in which case the Contractor shall receive his fifteen (15) per cent. profit on the wholesale cost to the company of any materials upon which profit would be allowed, were they purchased elsewhere.

Accounts

The Contractor's books shall at all times be open to the inspection of an expert accountant or accountants appointed by the Company to investigate the accounts.

The methods and times for payments shall be as described in the accompanying specifications, which form a part of this contract.

Workmen

Fourth.—The number of men to be sent from the United States to the work and their salaries or wages shall be subject to the approval of the Engineer, and he shall be satisfied as to their fitness before they are engaged. The number of men to be employed at each site shall also be subject to the Engineer's approval. He may order that the number be increased if, in his opinion, there are not enough, or that it be decreased, if it be too great for economic working.

Preparation

The Contractor shall purchase plant and materials in advance of the requirements, so as to have no idle men on the work. In case that he fails to do so, the Engineer shall have the right to prevent the Company from loss of money because of such negligence, by making an equitable reduction in the monthly payments.

The Engineer shall approve the purchase of all materials obtained outside of the Republic of Mexico and all important purchases of materials in same. The decision as to what purchases are important and what are not shall rest with the Engineer.

Vouchers

All expense bills are to be properly vouchered in triplicate

before being presented to the Engineer for his approval, and none shall be honored by the Company without his approval. The Engineer shall attach one set of vouchers to his monthly estimates, shall keep another set for his own records, and shall return the third to the Contractors.

All pay-rolls are to be signed by the payees in the presence of the Engineer or one of his duly authorized representatives; and when they are complete they shall be copied in duplicate in type-writing and the copies shall be attested by a notary. One attested copy is to be attached to the monthly estimate, the other is to be retained by the Engineer, and the original is to remain the property of the Contractor. In case of employees unable to write, the paymaster shall attach to the pay-roll an affidavit certifying that all the men on the said pay-roll have been paid in full. Pay-Rolls

The Company is not to be held liable for the failure of the Contractor to comply with any of the Mexican laws, especially those relating to books, accounts, and stamping of documents. Compliance with Laws

Before the plant is shipped to the site of the work it must be approved in writing by the Engineer; and the Contractor shall provide in advance whatever plant the Engineer may deem necessary for a satisfactory prosecution of the work.

Fifth.—All material paid for by the party of the first part shall be deemed to have been delivered to and to have become the property of the said first party; but the party of the second part hereby agrees to store it and to become responsible for it during the continuance of this agreement or until it has been placed in the work and accepted by the Engineer. If it be possible, all materials that are liable to injury by fire are to be insured to as near their full value at the place where stored as is practicable. In case that the Contractor fail so to insure and any of the Company's property that is in his charge be injured or destroyed, it shall be repaired or replaced according to the directions of the Engineer, and the cost of such repairs or replacements shall be deducted by the Engineer from the Contractor's monthly estimates. In case it be impossible to insure the said materials, the Company will stand the cost of all loss by fire, provided that, in the opinion of the Engineer, the Contractor used due diligence in caring for the materials so injured or destroyed; but the Company shall in no way be liable for injury to or loss of materials by water, flood, theft, or maliciousness. Delivery of Materials Insurance and Replacing

Right of Way

Sixth.—The party of the first part shall secure to the party of the second part the right to enter upon the places to be occupied by the structures and by the materials thereof during construction, free from cost, damage, or claim for damage of any kind whatever.

Seventh.—No change or alteration shall be made in the terms or conditions of this agreement without the written consent of both parties thereto.

Subletting

Eighth.—The party of the second part hereby agrees that it will not assign or sublet the work covered in this contract, or any portion of it, without the previous written consent of the party of the first part, but will keep the same within its control. It will not be the policy of the Company to permit any subletting by the Contractor, because its principal object in letting this contract for cost, plus a percentage for profit, is to avail itself of the said Contractor's experience, constructive skill, and ability to handle men and work.

Defects

Ninth.—If the Engineer should find occasion to reject and insist upon the removal and replacement of any portion of the completed or partially completed work, and if, in his opinion, the Contractor is to blame for the defects, the cost of such removal and replacement is to be deducted by the Engineer from the Contractor's monthly estimates.

Progress

Tenth.—If during construction it appear to the Engineer that the Contractor is not making proper progress on account of insufficient plant, labor, materials, supplies, or energy, the Company shall give the Contractor notice in writing that it is not satisfied with the progress that is being made, explain its conception of the reasons for the delay, and suggest remedies therefor. Then, if, after the expiration of twenty (20) days, the Engineer reports that the Contractor has not taken the steps indicated by the Company as necessary for a satisfactory prosecution of the work or other steps which, in the opinion of the Engineer, will prove equally effective, the Company shall have the right, after giving the Contractor a further twenty (20) days' notice in writing, to undertake itself, either by administration, or by letting the contract to other parties, the completion of the said work which is thus being neglected.

Abandonment

Under these circumstances the Company shall have the right to enter upon and take possession of the plant, tools, materials, and supplies of the said Contractor, or any part thereof; and in such case the Contractor shall be allowed a fair price for the use of all

plant returned, and compensation in full for any portion thereof used up or expended on the work.

This provision shall apply to the entire work involved in the contract as well as to any portion of it, which means in effect that if, in the opinion of the Engineer, the Contractor does not make a practice of prosecuting his work with due diligence, thoroughness, or economy, the Company shall have the right to finish the said work in the manner provided in this clause of the agreement.

Eleventh.—The decision of the Engineer shall control, etc., etc. Engineer's Decision
(This clause is taken without change from Waddell & Hedrick's standard form previously quoted.)

Twelfth.—(This also is from our standard form and covers the question of defense of lawsuits.)

Thirteenth.—Whenever the reserve of ten (10) per cent. of the Retained Percentage
monthly estimates, provided for in the contract, amounts to fifty thousand dollars (\$50,000.00), the Company shall pay to the Contractor twenty-five thousand dollars (\$25,000.00) on account, so that at all times after the first quarter-million dollars' worth of construction is allowed for in the estimates, there shall be a reserve in the Company's hands varying in amount between twenty-five thousand (\$25,000) and fifty thousand (\$50,000) dollars.

Fourteenth.—The Contractor further agrees to give to the Com- Bond
pany a good and satisfactory surety-company bond in the sum of fifty thousand dollars (\$50,000.00) gold for the faithful performance of this contract according to the specifications, and for the prompt payment for all material and labor used on the work, and to protect and save harmless the Company from all damages to persons or property caused by the negligence, or claim of negligence, of the Contractor, or his agents, servants, or employees in doing the said work or in connection therewith, the form of the said bond to be satisfactory to the Company. In case, though, on account of the construction being done in a foreign country, there be experienced special difficulty or expense in obtaining a satisfactory surety-company bond, the Contractor shall deposit with some Trust Company of New York City, to be named by the party of the first part, securities to the full value of fifty thousand dollars (\$50,000.00) as a guarantee instead of the aforesaid bond, which securities shall be satisfactory to the party of the first part. Whatever surety be decided upon, it shall continue in full force during the existence of this contract; and it shall not be waived or voided by any change in the plans, specifications, or amount of work involved, nor by any

change in the contract itself that, in the opinion of three arbitrators (one appointed by the surety company, one by the party of the first part, and the third by the two arbitrators thus chosen), is not in equity a good and sufficient cause for the cancellation of the surety. All these conditions will have to be agreed to in advance by the proposed surety company, or else its surety will not be considered by the party of the first part; and in case of a cash or equivalent guarantee, the party depositing the same will have to agree to the said conditions.

Arbitration

Fifteenth.—In case of any arbitration, if the two arbitrators first chosen refuse or fail to decide upon a third, the latter shall be appointed by the Mayor of New York City.¹

Engineer

Sixteenth.—The word "Engineer" as used in this contract refers to the Consulting Engineers of the Mexican Gulf Coastline Railway Company or their duly authorized representatives.

Registry of Contract

Seventeenth.—Either party to this agreement shall at any time have the right to make this contract a public contract according to the laws of the Republic of Mexico.

Abandonment

Eighteenth.—In case that at any time the Company decides to discontinue either temporarily or permanently the construction of its railroad or bridges, it shall have the right either to order the Contractor to cease operations until further notice or to cancel the contract. In the first case the Company shall pay all the expenses for closing down, storing, and taking care of the plant, and starting work again, also what, in the opinion of the Engineer, is a proper allowance for interest on cost of plant while it is out of use, together with fifteen (15) per cent. on these amounts for profit; and in the second case the Contractor is to be paid in full for all work done and materials furnished up to the date of cessation besides the entire cost of transporting the men and plant back to Kansas City, U. S. A., with the usual fifteen (15) per cent. added for profit.

Execution

IN WITNESS WHEREOF, the parties to this agreement have, in the City of New York, hereunto set their hands and seals.

Dated the day, month and year first herein written.

Attest.

.....
Secretary of the Mexican Gulf Coast-
line Railway Company.

[Seal]

Mexican Gulf Coastline Railway
Company.

By
President.

.....
Secretary of the Central Bridge Com-
pany.

[Seal]

Central Bridge Company.

By
President.

¹ The Mayor might decline to appoint, or his appointee might be a politician.

You may have noticed that while this contract contains many clauses that are not included in the ordinary type of construction contract, the latter has certain provisions that do not exist in the former, notably a clause for "liquidated damages." The reason for this omission is that under the assumed conditions it was impossible to set any dates for the completion of the various structures or of the entire work involved; hence no penalty could be demanded.

Liquidated Damages

I desire to call your attention to a feature of this method of letting work on a percentage basis that is, perhaps, foreign to the subject of the lecture—viz., the unusually large amount of labor that it involves for the engineers, who, in addition to their ordinary duties, have practically to assume the functions of administrators. For this reason their fees on such work should be greater than on ordinary contract construction.

Cost-plus-Percentage Plan

As it is my intention to send to each of you later a copy of this lecture, I am going to ask that you study the preceding contract carefully and check it against the list of requirements that I have given for scientific contract-writing, in order to see whether anything of importance has been omitted and how thoroughly the document has been prepared. This suggestion will apply also to all the succeeding examples of contracts. Such a study will do far more to teach you how to prepare proper contracts than would the listening to twenty lectures. You could, if you so desire, carry the study still further by assuming all the conditions precedent for some other type of contract, then prepare the document so as to embody in it all the principles and important features that I am advocating. On account of your inexperience in the business features of engineering, your productions would naturally be somewhat crude, but the benefit to yourselves from the preparation of such essays would be very great, especially if you were to submit them for criticism to some good legal authority.

Practical Problem,
Contract Plan

Contracts looking to the development of large enterprises are not uncommon, but the attendant conditions are generally rather vague and uncertain; hence the drafting of a proper agreement between the various parties concerned is quite a difficult matter.

Let us assume that there is a project on foot to build in Colorado a large dam across Lonetree Gulch for the double purpose of irrigating the lands below the site and of developing electric power to be transmitted to Denver, and that a company named the Lonetree Gulch Development Company has been duly organized

Example, Promoters'
Agreement

under the laws of the State of Colorado by John Smith and Arthur Jones, real estate brokers of Denver, for the purpose of consummating the enterprise. Let us assume also that these men in doing the preliminary work necessary to secure the charter, after spending four thousand dollars (\$4,000.00), have exhausted all of their resources, and that, in order to bring the project into proper shape to present to financiers, considerable expensive engineering work is essential. On this account they have gone to Wallace & Henderson, Consulting Engineers, of Kansas City, Mo., who make a specialty of engineering large enterprises, and requested their assistance. These engineers have called in Green & Robinson, electrical engineers, also of Kansas City, Davidson & Osgood, masonry contractors, of Chicago, and Holman & Curtis, grading contractors, of Denver, to share with them the expense of doing all the preliminary work, which they estimate will cost \$6,000 in actual cash, with no allowance for personal engineering services.

Enterprise

The original promoters have agreed to deliver to the engineering and contracting firms eighty (80) per cent. of their entire holdings in the enterprise, in compensation for the engineering work necessary to prepare a presentation of the scheme so thoroughly drawn that it will receive due consideration from capitalists. The two contracting firms have agreed to subscribe six thousand dollars (\$6,000.00) each to the general fund. The two engineering firms are to receive three thousand dollars (\$3,000.00) each as compensation in full for their cash outlay, and are to devote their time and attention to the preliminary work continuously till its completion.

Franchise

It is understood that the Lonetree Gulch Development Company has organized and has held sufficient meetings to enable it to secure from the State of Colorado the charter for constructing the dam, irrigation system, and power plant, but that no stock has been issued, only enough having been subscribed for to qualify the board of directors. The promoters value their charter and the recorded results of the work that they have done at fifteen thousand dollars (\$15,000.00), but are willing to dispose of eighty (80) per cent. of their entire holdings for a preliminary cash payment of four thousand dollars (\$4,000.00), and eight thousand dollars (\$8,000.00) to be paid to them by the two contracting firms and the two engineering firms jointly immediately after the enterprise is financed and when compensation for their past and future work is assured.

Charter of Limitations

It is understood also that, as the Lonetree Gulch Development

Company's charter will expire in about six (6) months, the original promoters are to have its privileges extended by the State Legislature for another three years, and that this must be done before the first payment of four thousand dollars (\$4,000.00) on account will be made by the purchasers.

The eighty (80) per cent. of their holdings that the promoters Compact sell is to be divided equally among the four buyers, so that each engineering company, each contracting company, and the original promoting company shall hold twenty (20) per cent. of the capital stock when it is distributed, which will be after the preliminary engineering work is done and before the financiers are approached.

After paying the promoters four thousand dollars (\$4,000.00) on account and the engineers six thousand dollars (\$6,000.00) to reimburse them for their cash expenditures, there will be left two thousand dollars (\$2,000.00) out of the twelve thousand dollars (\$12,000.00) subscribed by the two contractors. This balance is to be held by the Consulting Engineers to defray traveling and other expenses incident to the financing of the project after the preliminary engineering work and estimates are completed. Engineering Expenses

It is further understood that the bargain made with the financiers is to be conditioned on Wallace & Henderson being retained as principal engineers of the enterprise, with Green & Robinson as consulting electrical engineers, and that the total compensation for engineering is to be not less than five (5) per cent. of the entire cost of the work, including right of way and all other expenses connected with the consummation of the enterprise and completion of the construction, which fee is to be divided between the two firms in the ratio of the contract prices of the portions of the construction under their respective jurisdictions. It is also conditioned on the understanding that the contract for the masonry dam and for the construction required for power development and transmission is to be given to Davidson & Osgood, and that for the irrigation works and any other construction that there may be to Holman & Curtis, at schedule rates determined by the Consulting Engineers on the basis of estimated actual cost plus twenty (20) per cent. for profit. Engineering Talent

It is understood that in dealing with the financiers the latter will demand a large portion of the capital stock, and that the exact amount thereof which they are to receive will be settled by mutual agreement between the financiers on one side and the five interested parties on the other, and that the decision of a majority of the five Financial Backing

in respect to this and all other matters in controversy shall govern. After the amount of stock to be relinquished is determined, each of the five equal holders of the entire stock shall relinquish the percentage of his holdings that has been agreed upon.

Draft of Contract

Under the preceding circumstances and conditions the following is the draft of contract that I would make to define and secure the interests of all concerned and to prevent, if possible, the financiers from taking more of the cream of the enterprise than the amount to which they are justly entitled:

Parties

MEMORANDUM OF AGREEMENT, Made and signed this twentieth day of March, 1905, by and between John Smith and Arthur Jones, the party of the first part and sometimes termed herein the "Incorporators," real estate brokers of Denver, Colo., and sole owners of the stock in the Lonetree Gulch Development Company, a corporation of the State of Colorado, and the firm of Wallace & Henderson, Consulting Engineers, of Kansas City, Mo., the party of the second part, and sometimes termed herein the "Consulting Engineers," and the firm of Green & Robinson, electrical engineers, of Kansas City, Mo., the party of the third part, and sometimes termed herein the "Electrical Engineers," and the firm of Davidson & Osgood, masonry contractors, of Chicago, Ill., the party of the fourth part, and sometimes termed herein the "Masonry Contractors," and the firm of Holman & Curtis, grading contractors, of Denver, Colo., the party of the fifth part, and sometimes termed herein the "Grading Contractors."

The four firms—viz., Wallace & Henderson, Green & Robinson, Davidson & Osgood, and Holman & Curtis—respectively the second, third, fourth and fifth parties to this agreement, are sometimes hereinafter termed the "Purchasers," the five parties to the contract are hereinafter sometimes termed collectively the "Syndicate," and the financiers who will later be requested to subscribe the money for the construction will be termed for convenience the "Bankers."

Preambles

WHEREAS, The party of the first part as incorporators and sole stock-owners of the Lonetree Gulch Development Company has obtained from the State of Colorado a charter permitting it to build a dam across Lonetree Gulch at a point to be selected by its engineers for the purpose of irrigating certain lands and developing and transmitting power, and

WHEREAS, The party of the first part has spent in cash some four thousand dollars (\$4,000.00) on preliminary surveys and borings, and

WHEREAS, The party of the first part recognizes the fact that, in order so to present its project to capitalists as to induce them to subscribe for the bonds of the Company, it is necessary to do considerable expensive engineering work and to prepare from the results of its preliminary plans, specifications, estimates of cost, estimates of revenue, and other papers; and has in consequence approached the party of the second part with the suggestion that it form a combination to buy a controlling interest in the company and to do all the said preliminary engineering work and finance the project, and

WHEREAS, The party of the second part, not being expert in electrical engineering, has decided to take in with it the party of the third part to do all the engineering on the power development, and

WHEREAS, The engineers, not having the necessary cash to spare for the development of the enterprise, have called in the parties of the fourth and fifth parts to take a share of it in consideration of their furnishing the money required for the preliminary expenses, and

WHEREAS, The parties of the second and third parts desire to secure the entire engineering work involved in the construction of the dam and irrigation plant, and in the development of the power, and

WHEREAS, The parties of the fourth and fifth parts desire to secure contracts for building the dam, irrigation plant, and all the machinery, houses, and other constructions for power development.¹

NOW THIS AGREEMENT WITNESSETH:

First.—The party of the first part hereby agrees, for a consid- Stock Consideration
eration hereinafter mentioned, to transfer to the parties of the second, third, fourth, and fifth parts, jointly, eighty (80) per cent. of its entire holdings in the said project, including the before-mentioned charter from the State of Colorado, and all the plans, notes of surveys, and estimates made to date by or for the party of the first part, in order that the Purchasers may use them in their work of completing the plans, estimates, and other documents to present to financiers.

¹ A good practice is to insert a general clause, making mutual covenants or agreements between the parties, thus:—"For and in consideration of the mutual agreements herein contained, it is hereby mutually agreed between the parties hereto as follows:"

Stock Distribution

Second.—As payment for the said eighty (80) per cent. of the Incorporators' holdings the Purchasers agree as follows:

A. To pay to the Incorporators the sum of twelve thousand dollars (\$12,000.00), four thousand dollars (\$4,000.00) thereof within thirty (30) days after the extension of the charter for another three (3) years has been granted by the State of Colorado, and the remaining eight thousand dollars (\$8,000.00) within thirty (30) days after the entire project has been financed, the capital secured, and the Purchasers assured of their contracts for the engineering and construction of the entire work by payment to them from the Bankers of not less than twenty thousand dollars (\$20,000.00) on account.

Subject-Matter

B. To do at their own expense all the preliminary engineering work required for putting the project in proper condition to present to capitalists, including surveys for the dam, irrigating ditches, and transmission line for power; borings for the foundations of the dam; plans and specifications for the dam, irrigation system, and power development and transmission; a complete detailed estimate of cost of the entire enterprise, including right of way, land, construction, machinery, legal fees, administration, and engineering; a complete and detailed estimate of probable earnings, and an exhaustive and well-drafted prospectus.

Best Endeavors

C. To do their best (with the aid of the Incorporators) to finance the project and to secure bonuses and other aid from the United States and State Governments and from individuals who would be directly benefited by the consummation of the enterprise, and thus by the united efforts of the entire Syndicate to secure the necessary money to build the said dam, irrigation system, and power plant.

Preliminary Operations

Third.—The parties of the second and third parts, in consideration of certain remuneration hereinafter mentioned, hereby agree to do at their own expense all of the before-mentioned preliminary engineering work, including the making of all surveys, borings, plans, and estimates, and the preparation of the prospectus, and to give to the said work their undivided attention and the full benefit of their experience and professional skill. They also agree to finish in the shortest practicable time consistent with thoroughness the entire work previously described.

Working Capital

Fourth.—The parties of the fourth and fifth parts hereby agree to deposit in the hands of the party of the second part six thousand dollars (\$6,000.00) each so as to form a working capital of twelve

thousand dollars (\$12,000.00), which capital will hereinafter be termed the "Purchasers' Fund." This fund is¹ to be utilized in making the first payment of four thousand dollars (\$4,000.00) on account to the Incorporators, paying for the preliminary engineering work, and presenting the fully prepared project to the Bankers.

Fifth.—The parties of the second and third parts are to be¹ paid Advances out of the Purchasers' Fund the sum of six thousand dollars (\$6,000.00), to be divided equally between them as compensation for their cash outlay in connection with the preliminary engineering work described previously; and this amount is to¹ be paid to them as soon as they deliver to the Syndicate the complete papers for submission to the Bankers.

Sixth.—As soon as the preliminary engineering work is finished Stock Issue and the various papers depending upon it are prepared, a copy of each of the said papers shall be delivered to each member of the Syndicate, and within ten (10) days from the date of such delivery the Incorporators shall issue and distribute to the Purchasers their eighty (80) per cent. of the capital stock of the Lonetree Gulch Development Company. The amount of stock thus delivered to the Purchasers shall immediately be distributed equally among the four firms of which the said Purchasers are composed.

Seventh.—The two thousand dollars (\$2,000.00) remaining in Exploitation the Purchasers' Fund after the Promoters and the Engineers are paid is to be used in presenting the project to the Bankers; and in case that it be insufficient for the purpose, each member of the Syndicate will be required to contribute to the said fund from time to time a certain small sum of money to be determined by the Consulting Engineers as requisite for the purpose.

Eighth.—When the Syndicate is making its bargain with the Bonus Bankers for the development of the project, it will be necessary to turn over to them a portion of the capital stock of the Company, which portion the Syndicate will naturally strive to make as small as possible. Each of the five parties to this agreement shall turn over to the said Bankers the portion of his total stock agreed upon, thus leaving the said five members equal owners of the balance of the said capital stock.

This entire balance of stock is to be deposited with a Trustee, Stock Syndicate selected by a majority vote of the five members of the Syndicate, to be held by him until the completion of the entire construction of the

¹ The substitution of the future "shall be" for the infinitive "is to be" is preferable.

dam, irrigation system, and power plant. Should, however, as hereinafter provided for, any member of the Syndicate be expelled by a majority vote of that body, the Trustee shall transfer on his books, as directed by the Syndicate, the stock of the said expelled member. As soon as the said construction has been completed and the accounts of the Syndicate have been finally settled, but not before, the Trustee shall deliver to the owners thereof the stock standing in their names on the books.

In case of any disagreement between the members of the Syndicate concerning the proportion of the total stock to be relinquished to the Bankers or concerning any other matter not specially covered herein, a majority vote of the said members of the Syndicate shall rule, and there shall be no appeal from any formal decision of the majority of the said Syndicate.

Promoters to Stand
Firm

Ninth.—When the Syndicate makes its bargain with the Bankers, its members shall stand firm for the following basis of agreement, and no modification whatsoever shall be made in the terms thereof without the unanimous consent in writing of all five members of the said Syndicate.

A. The party of the second part is to be retained to do the entire engineering work in connection with the designing and construction of the dam and irrigation system.

B. The party of the third part is to be retained to do the entire engineering work in connection with the designing and construction of the power plant and the power transmission line.

C. The compensation of the engineers for the work that they do after the project has been financed shall not be less than five (5) per cent. of the entire cost of the enterprise (barring, of course, the cost of the engineering itself); and they shall divide the total fee between them in the proportion that the contract cost of the work done under each one's charge bears to the total contract cost of the entire work.

D. The party of the fourth part is to be given the contract for building the dam, power plant, and transmission line at schedule rates figured by the Consulting Engineers on the basis of actual cash cost, plus twenty (20) per cent., for profit.

E. The party of the fifth part is to be given the contract for constructing the irrigation system and any other construction there may be besides that herein mentioned, at schedule rates figured by the Consulting Engineers on the basis of actual cash cost, plus twenty (20) per cent., for profit.

F. In case that either the Bankers or the Contractors fail to approve the Consulting Engineers' figures for the schedule prices, the dispute is to be settled by arbitration, one arbitrator being appointed by each of the two disputants and the third by the two thus chosen. In case that the said two fail to agree upon a third arbitrator, the latter is to be appointed by the Governor of the State of Colorado. By the decision of a majority of these three arbitrators the said schedule rates are to be finally determined.

G. In case that the Bankers decide that the construction is to be done by some other organization than the Lonetree Gulch Development Company, the members of the Syndicate are to receive free of charge the same percentages of stock in the new organization as it was agreed upon that they were to retain finally in the original company.

Tenth.—The entire agreement is based upon the assumption that the Legislature of the State of Colorado will grant to the Lonetree Gulch Development Company, its successors or assigns, an extension of time of three (3) years for starting work upon the construction and the same amount for the completion thereof. If the said extension of time be refused by the Legislature, this agreement is to become null and void. Conditions Precedent

Eleventh.—If in the future it be found necessary to obtain from the Colorado Legislature any further extension or extensions of time for either starting or finishing the construction, or for both, the Purchasers and the Incorporators hereby agree to use their best united efforts to secure such extension or extensions; and any expense incurred in obtaining such extension or extensions shall be borne equally by the five parties to this agreement. United Efforts

Twelfth.—The obligations and benefits of this agreement are to be binding upon and to accrue to not only the various parties to this agreement, but also their executors, administrators, successors, or assigns, as the case may be. Legal Representatives

Thirteenth.—This agreement shall continue in existence either until the entire project is consummated, or until the charter of the Company lapses because of failure to have it extended. Duration of Contract

Fourteenth.—In case that the Syndicate and the Bankers come to terms and the construction proceeds, the parties of the second and third parts hereby agree to devote to the engineering work their full time and best attention, and to give to it the benefit of their experience and skill; and the parties of the fourth and fifth Undivided Attention

parts hereby agree to do all the contracting work in a thorough and workmanlike manner and in strict accordance with the plans, specifications, and instructions of the engineers, all for the purpose of insuring that the entire construction shall be first-class in every particular and a credit to everybody concerned in its designing and building.

Harmony Pledged

Fifteenth.—All the members of the Syndicate hereby pledge themselves that they will in all cases try to act in harmony and to do all they can to develop the project and accomplish the aims for which the Syndicate was formed and which this document expounds.

Expulsion from Syndicate

Sixteenth.—In case that any party of the Syndicate fails to keep the agreements into which it has entered in this document, it shall be given written notice by a majority of the said Syndicate to the effect that it is not acting in a manner which will redound to the best interests of the Syndicate, and that if it does not modify satisfactorily to the Syndicate its objectionable actions within twenty (20) days, it will be expelled from the said Syndicate.

Sale of Stock

In this case the Syndicate will choose a successor and will sell to him for as large a sum of money as possible the entire holdings of the expelled party, including the stock deposited in the Trustee's hands, if any be then so deposited, and will deliver to the said expelled party the said sum of money, less the amount required to settle the expelled party's indebtedness to the Syndicate as a body and to its individual members, and to square all accounts of the said expelled party in connection with its work that is covered in this agreement. If the price at which the said stock is to be sold be unsatisfactory to the expelled party, the latter shall have the privilege of trying for the space of thirty (30) days to obtain a better price; and if the said expelled party secure a better price, the Syndicate shall either buy the stock at that price or allow the expelled party to sell it.

Alterations

Seventeenth.—No change or alteration shall be made in the terms or conditions of this agreement without the consent of all five (5) parties hereto in writing.

Subletting

Eighteenth.—The parties to this agreement hereby agree that they will neither sublet any of the work herein described nor sell any portion of their interests without the consent of all five (5) parties hereto in writing.

IN WITNESS WHEREOF, the parties to this agreement have hereunto set their hands and seals at the City of Denver, Colo. Dated the day, month, and year first herein written.

Execution

Witnessed by
 (Seal)
 (Seal)
 (Seal)
 (Seal)
 (Seal)

The preceding contract is a very complicated document, possibly as complicated as any of you are ever likely to be required to draft. It has been written with care and has been checked by competent authority; hence it ought to serve well as a model for drafting agreements between several parties.

Form Proposed

The next type of contract that I shall present is one between the promoters of an enterprise and capitalists whose aid they are seeking to finance it.

Let us assume that the same firm of engineers—viz., Wallace & Henderson, of Kansas City, Mo.—has developed the project for building a toll bridge over the Arkansas River and an electric railway between the cities of Van Buren and Fort Smith, and has formed in Arkansas a company named the Van Buren and Fort Smith Bridge and Railway Company to build the proposed line and structure; also that it has obtained a charter from the United States Government for bridging the river and franchises from the two cities for the construction of the electric railway; also that all steps thus far have been taken in a perfectly legal manner, and that the Company's books and records are in proper shape. Only enough stock has been subscribed to qualify the directors, and the entire stock is thus far controlled by the firm of engineers.

Example, Agreement to Finance

It is assumed also that these engineers have taken the project to a firm of brokers, Raymond & Effingham, of Philadelphia, who are themselves capitalists, but who are not strong enough financially to underwrite the entire issue of bonds, the amount of cash required for the enterprise being in the neighborhood of eight hundred thousand dollars (\$800,000.00).

Scheme Outlined

Under these conditions the contract that I would draft is as follows:

MEMORANDUM OF AGREEMENT,

by and between A. J. Wallace and G. I. Henderson, Consulting Engineers, both of Kansas City, Mo., and copartners, doing business

Parties Described

under the firm name of Wallace & Henderson, the party of the first part, and sometimes hereinafter termed the "Promoters," and P. J. Raymond and S. L. Effingham, both of Philadelphia, Pa., copartners, doing business under the firm name of Raymond & Effingham, the party of the second part, and sometimes hereinafter termed the "Brokers."

Preamble

WHEREAS, The said Wallace & Henderson have prepared complete in every essential particular a project for building an electric railway between Van Buren and Fort Smith in the State of Arkansas, with a toll bridge for vehicular and electric railway traffic to cross the Arkansas River on the line of the said railway, and have organized in the State of Arkansas a company for building the said railway and bridge, and have taken the said project to the said Raymond & Effingham to finance with a resulting mutual benefit to both parties, now, therefore,

THIS AGREEMENT WITNESSETH:

Declaration

First.—The incorporated name of the Company for building the electric railway and bridge is the Van Buren and Fort Smith Bridge and Railway Company, and the entire stock thereof is now owned and controlled by the party of the first part.

Financial Scheme

Second.—The party of the first part hereby agrees to place in the hands of the party of the second part, and in its hands only, the financing of its project to build the said electric railway and bridge.

Third.—The party of the second part hereby agrees to use its best efforts to effect the underwriting of the bonds of the said Company, and in every way to endeavor to finance the project with the least possible delay.

Fourth.—The parties hereto hereby agree to divide equally between them all profits resulting from the disposal of the Company's securities.

Duration

Fifth.—The duration of this contract shall be six (6) months from the date of its signature, but its life may be extended by the consent of both parties hereto in writing.

Sale of Bonds

Sixth.—The amount of bonds to be sold for developing the project shall be one million dollars, and the Brokers in disposing of them are to obtain as high a price as possible, under no circumstances parting with them for less than eighty-five (85) cents on the dollar.

Capital Stock

Seventh.—In dealing with the bankers and underwriters, the Brokers are to keep as low as possible the percentage of the capital

stock of the Company that is given with the bonds; and under no circumstances shall the amount so given, hypothecated, or pledged be so large as to cause the control of the enterprise to pass out of the hands of the parties of the first and second parts.

Whatever stock is left over after the arrangement with the bankers and underwriters is consummated is to be divided equally between the two parties to this agreement.

In case that the Brokers in making the sale of the bonds find it necessary to part with more than forty (40) per cent. of the capital stock, they shall not finally agree to do so until after they have received in writing the assent of the Promoters to the proposed arrangement. Stock Bonus

Eighth.—It is not contemplated that either Wallace & Henderson or Raymond & Effingham will be underwriters for the bonds, but either of them may subscribe, if they so desire, and they shall receive with the bonds they buy the proportion of stock set apart to go to the underwriters, the same as if they were in no other way connected with the project, and in addition to and entirely apart from any profits to be divided under this agreement. Privilege of Promoters.

Ninth.—The Brokers hereby agree that in any financial arrangement entered into by them they will see that there is provision made by which the party of the first part shall be retained as engineers of the Company to design and supervise the construction of the railway and bridge, with full control over all matters of an engineering character, and that they shall receive in compensation for their services and for those of their assistants a gross fee of not less than five (5) per cent. of the grand total cost of the railway and bridge, excluding from the said total only the Engineers' and the Brokers' fees. Engineers to be Retained

In the same manner the Promoters agree, in so far as it is within their control, to see that Raymond & Effingham receive for their services in financing the project a gross fee of three (3) per cent. of the said grand total cost, computed as just described. Commission

It is distinctly understood, however, that neither party hereto is assuming individual or personal liability to the other for the said fee, but both parties are in good faith to do everything which lies in their power or control to see that the said fees are paid.

Tenth.—No change or alteration shall be made in the terms or conditions of this agreement without the consent of both parties hereto in writing. No Changes

IN WITNESS WHEREOF, the parties to this agreement have hereunto set their hands and seals in the City of Philadelphia, Pa., this twentieth day of March, 1905.

Witnessed by
..... (Seal)
..... (Seal)
..... (Seal)
..... (Seal)

Example, Copartner-ship

I shall give you before closing one more example of contract preparation, illustrating a type of agreement that may be useful to you some day. It is a partnership contract between two engineers. Let us assume that Mr. M. S. Clements, hydraulic and sanitary engineer, of St. Louis, Mo., who has been practising successfully there in those specialties for many years, desires to take in as junior partner his principal assistant engineer, Mr. K. L. Strange, and that all the details of the partnership have been settled. I shall not state them in advance, as they will appear in the document, which I would draft thus:

Introduction

MEMORANDUM OF AGREEMENT, by and between M. S. Clements, Civil Engineer, of St. Louis, Mo., the party of the first part, and K. L. Strange, Civil Engineer, of St. Louis, Mo., the party of the second part.

Preamble

WHEREAS, The party of the first part has for many years been established in St. Louis, Mo., as a consulting hydraulic and sanitary engineer, and has developed a large and successful practice, and
WHEREAS, The party of the second part has been in the employ of the party of the first part for over seven (7) years, and during the last three (3) years has been his Principal Assistant Engineer, and

WHEREAS, The parties to this agreement have concluded that it will be mutually beneficial to enter into a partnership to prosecute the business of civil engineering in the special lines of hydraulic and sanitary work,

NOW THIS AGREEMENT WITNESSETH:

- Name First.—The name and designation of the firm shall be Clements & Strange, Consulting Engineers.
- Duration Second.—The agreement shall be operative on and after January 1, 1905.
- Salary Third.—The party of the second part shall in any event receive fifteen hundred dollars (\$1,500.00) per annum; i. e., if his share of

the net profits for any year be less than that amount, the difference between his said share and the said amount shall be paid to him out of the total profits of the firm for the year, or, failing these, by the party of the first part.

Fourth.—The share of the net profits of the party of the second part shall be as follows: Share in Profits

Up to January 1, 1908, twenty-five (25) per cent.; from then until January 1, 1911, thirty (30) per cent.; from then until January 1, 1914, thirty-five (35) per cent.; from then until January 1, 1917, forty (40) per cent., and after the latter date, forty-five (45) per cent.

Fifth.—The net profits for any year shall be figured by subtracting from the gross receipts for the said year the entire business expenses for the year, such as those incurred in doing office work, field work, traveling, and advertising, but the aforesaid guaranteed amount of fifteen hundred dollars (\$1,500.00) per annum shall not be considered as a part of the office expenses. Profits Defined

Sixth.—An accurate set of books shall be kept, from which can readily be computed the net profits for the year, and a cash settlement shall be made at the beginning of each year for the preceding year. Books of Account

Seventh.—If any completed piece of work be unpaid for at the end of the year, it shall be assumed as paid for in making the settlement; but the party of the second part shall not receive his share of the delayed payment until after the said payment is made. Payments of Shares

Eighth.—At any time after January 1, 1914, the party of the second part shall have the privilege of purchasing the balance of a half-interest in the business by paying to the party of the first part in cash one of the following sums, according to the date of the establishment of the equal partnership. Increasing Interest

In 1914.....	\$15,000.00
In 1915.....	13,000.00
In 1916.....	11,000.00
In 1917.....	9,000.00
In 1918.....	7,000.00
In 1919.....	5,000.00
After 1919.....	3,000.00

The payment of any one of the preceding amounts shall not only entitle the party of the second part to a half-interest in all future business, but shall also make him a half-owner of all office fixtures, library, instruments, patents, records, and field apparatus that may Firm Property

be owned by the party of the first part at the time of the formation of the equal partnership, it being understood that all apparatus, books, etc., etc., purchased for the firm before the establishment of the equal partnership shall be the personal property of the party of the first part, or simply an addition to his present office property, notwithstanding the fact that they have been paid for out of the funds of the firm.

Patents

Ninth.—All royalties from patents owned by the party of the first part on January 1, 1905, shall be thrown into the gross profits of the business.

Joint Patents

Tenth.—If in the future any joint patent is taken out, it shall be the property of the office, and any royalty or other gain therefrom shall be thrown into the gross receipts of the office. In case of a dissolution of partnership at any time, the future interest of all such joint patents shall be arranged according to the basis of division of office profits governing at the time of the said dissolution, and both parties shall afterward have the right to use such patents for their own professional work without accounting; but in case of royalty thereon by other parties, the amount of said royalty shall be divided between the two parties to this agreement according to the basis of division herein provided for.

Joint Efforts

Eleventh.—Neither party to this agreement shall take out for himself any patent for anything connected directly or indirectly with the work of the office without first obtaining from the other party written permission to do so; but a written refusal or a verbal refusal in the presence of witnesses to enter into a proposed joint patent shall be considered an equivalent to giving such written permission.

Copyrights

Twelfth.—If the parties to this agreement write a joint book for publication, the profits on same shall be considered a part of the office receipts, and shall be divided accordingly; and any technical book written by either party shall be treated in like manner as long as the partnership continues. In case of a dissolution of partnership, each party shall, for the future, own outright any books published in his own name; also the percentage of interest in all joint books that is the basis of division of office profits governing at the time of the said dissolution.

Authorship

The party of the second part, however, shall be entitled to no pecuniary interest in any books written by the party of the first part prior to January 1, 1905, even though future additions thereto be

made. On the other hand, no expense connected with such solely individual books shall be considered a part of the office expenses.

Thirteenth.—Whenever the contemplated future equal partnership is consummated, the profits on all contracts for work entered into before the date of the equal partnership shall be divided according to the terms of this agreement, and shall not be considered as pertaining to the said equal partnership. Equal Interests

Fourteenth.—In the event of the death of the party of the first part before the formation of the contemplated equal partnership, the party of the second part shall have the privilege of purchasing the good-will of the business, together with all of the office fixtures, library, records, instruments, and other property connected with the business, except as hereinafter stated, by paying to the estate of the party of the first part the sum of three thousand dollars (\$3,000.00) in cash or in an equivalent that will be satisfactory to the executors of the said estate. Death

It is understood that this sum does not cover any patents, either individual or joint, but that the estate of the party of the first part shall have a half-interest in all royalties therefrom, unless after the death of the party of the first part, the party of the second part purchases from the estate the said patents or shares in patents. And the party of the second part at the settlement of the office affairs, after the death of the party of the first part, shall have the privilege of purchasing all of the said patents at a price to be agreed upon between the said second party and the said executors; and if an agreement as to their value cannot be otherwise arrived at, the price shall be settled by arbitration, the party of the second part appointing one arbitrator, the executors another, and the two thus chosen, the third. In case of failure of the two arbitrators first chosen to determine upon a third, the latter shall be appointed by the Mayor of St. Louis. By the decision of the majority of these three arbitrators both the party of the second part and the executors shall be finally bound. Settlement Arbitration

In case, however, the party of the second part elects not to purchase the said patents, he shall have the use of the joint patents by special agreement in each case with the executors, but the latter shall have full control of all Clements' individual patents. Use of Patents

In case of the death of the party of the first part, either before or after the formation of the contemplated equal partnership, the party of the second part shall finish all work on all contracts then uncompleted, and shall pay over to the estate of the said first party Completion of Work

the latter's full share of all net profits thereon, as computed by the rate of division governing at the date of his death.

Net Profits

Fifteenth.—In case of the death of the party of the second part prior to that of the party of the first part, the estate of the former shall receive the same percentage of net profits from all unfinished work as would have been his under the terms of this contract at the time of his death. And the party of the first part shall have the use of all joint patents held by the firm, but the estate of the party of the second part shall be entitled to the same percentage of royalties accruing from the use of the said joint patents as the party of the second part would at the time of his death have been entitled to under the terms of this contract.

Sale of Patents

Provided that the party of the first part shall have the privilege of purchasing from the Strange estate the interest in all joint patents held by the party of the second part at the time of his death, according to the arrangement previously outlined for the case of the death of the party of the first part.

Control

Sixteenth.—Until the contemplated future equal partnership be entered into, the policy and management of all business affairs shall rest entirely with the party of the first part, but the party of the second part shall be consulted, as in the past.

Cancellation

Seventeenth.—Should either party to this agreement at any time desire to cancel the same, he shall give in writing to the other party twelve (12) months' notice of his intention to do so; and, in case of failure so to notify, he shall, at the date of severing his connection with the business, pay to the said other party in cash the sum of one thousand dollars (\$1,000.00), which amount shall not be considered as a penalty, but as liquidated damages (for loss to the said other party) herein agreed upon by the contracting parties.

Dissolution

Eighteenth.—In case of a dissolution of partnership with twelve (12) months' notice, all work connected with contracts entered into before the giving of notice of dissolution shall be completed, if possible; and the profits thereon shall be divided according to the terms of this contract. All new work taken during these twelve (12) months shall belong to the party who is to continue the business and shall be done at his expense, the other party being concerned with it in no manner whatsoever. If at the end of twelve (12) months there still be any old work uncompleted, the party who continues the business of the office shall finish it and shall give to the other party after the final settlement therefor is made his proper share of the net profits thereon. It is understood that, unless other-

wise agreed upon, the party of the first part shall be the one to carry on the business in case of a dissolution of partnership.

Nineteenth.—But in the case of dissolution of partnership without the twelve (12) months' notice, there shall be made an immediate settlement of the affairs of the firm, by which the party leaving shall be paid by the other party in either cash or notes a fair allowance for his interest in all unfinished contracts. If the two parties cannot agree upon the terms of the settlement, the matter shall be fixed by arbitration in a manner similar to that hereinbefore described.

Notice of Dissolution

Twentieth.—No change or alteration shall be made in the terms or conditions of this agreement without the consent of both parties hereto in writing.

No Changes

Twenty-first.—The parties to this agreement hereby agree that they will at all times do all that lies in their power to further and increase the business of the firm, and to establish for it a world-wide reputation for doing thorough, honest, scientific, economic, and skilful work.

Effort

IN WITNESS WHEREOF, The parties to this agreement have hereunto set their hands in the City of St. Louis, Mo., this tenth day of December, 1904.

Execution

Witnessed by

.....
.....

In concluding this lecture there are a few general matters of importance to which I desire to call your attention, especially as they are often ignored in the preparation of contracts.

Conclusion

No erasure with a knife, rubber, or other similar instrument should be made in any legal document, but if a mistake has occurred, it should be lined out in the case of handwriting and crossed out with a close repetition of the letter x in the case of typewriting. Corrections like these must evidently have been made while the document was being transcribed and before it was signed, while in case of an erasure no one can say what was originally written, or that the correction was not made after the signing of the document. As a matter of precaution, it is advisable to have each signer of a contract initial on the margin of the page on which it occurs each correction that the document contains. This will show conclusively that all the interested parties concurred in making the changes. However, if a draft of an agreement contain many such corrections, it is better to have it recopied before obtaining the signatures.

Erasures and Corrections

Fraudulent Changes

Theoretically, every contract should be written on a single page, for otherwise what is there to prevent a dishonest person from removing all the pages except the last and replacing them with similar pages containing matter prepared in his own interests? Some people meet this objection by pasting together in one continuous piece all the sheets of the document and marking in red ink on the joined parts a waved line that passes alternately from one sheet to the other. Others take the precaution to have all the parties to the agreement initial each page of the bound sheets. The manifolding of typewritten documents is a fairly good means for preventing the making of fraudulent changes in such papers; but in case that all copies but one are destroyed, this check would become inoperative.

Sunday Laws

Contracts executed on Sunday are illegal. They may be agreed upon and drafted on Sunday, but to be valid they must be dated and signed on some other day of the week.

Deliberation

It is always advisable to let a contract "get cold" before signing it; *i. e.*, it should be set aside for at least one night and read over carefully the next day by all the parties in order that each may make sure that the document expresses exactly in every particular what has been agreed upon verbally, and that there is no clause in it prejudicial to his interests. By giving the mind a rest one is often able to comprehend a document more clearly and thus save himself or his clients from future trouble or pecuniary loss.

Counsel

After an engineer has prepared a contract and has added all the finishing touches to it, he should submit the draft before it is signed to a competent lawyer for his comment. This is better than letting the lawyer draw it in the first place, for I contend that a competent engineer can draft an engineering contract better than any lawyer; nevertheless, an independent check is necessary for any important document, and who so competent to check a legal paper as an attorney!

Length of Discourse

When I started to write this address it was my intention to conclude it with a short summary of the Law of Contracts, but its dimensions are already far in excess of those I originally contemplated, and perhaps, also, some of you may be thinking, in excess of the legitimate limits of a lecture to long-suffering engineering students; consequently I shall instead advise you to study the subject carefully in such standard works as those of Wait, Johnson, and Parsons. I trust that listening to this address and studying it later after it is printed will lead you better to comprehend and

to appreciate the *dicta* of legal authorities on the subject of Engineering Contracts.

Finally, I desire to call your attention to the fact that I have by no means endeavored to cover in this address the entire ground of this important subject, but only to show you its practical features and how you may prepare yourselves by hard study to become expert in the preparation of legal-engineering documents.

Examples for Practice in Contract Writing.

Cases for Practice

It will not be necessary for the student, before starting to write one of the contracts outlined in the following list, to obtain specimens of actual contracts for similar cases, because all the necessary instructions for doing such writing are given in the preceding lecture. Nevertheless, it would do him no harm were he to peruse in advance of beginning his work a few such contracts. He would probably find, though, that they do not come up to the criterion of excellence and thoroughness given in that lecture; and on this account it would hardly pay either him or his professor to take much trouble to obtain such specimens of actual contracts.

In case that the student finds that the "Conditions Precedent" are not complete enough to enable him to draft a proper contract for any one of the following "Cases," he will be at liberty to supply as he may see fit such omitted conditions.

CONDITIONS PRECEDENT FOR CONTRACTS TO BE DRAFTED FOR PRACTICE BY ENGINEERING STUDENTS.

CASE NO. 1.

Electric Street Rail- way and Viaduct

The firm of Winans & Jenkinson, Consulting Engineers, of Washington, D. C., has agreed with the Capital Rapid Transit Company, of Richmond, Va. (a corporation of that State), to do all the engineering work in connection with the exploiting of that Company's project to build an electric street railway line and a toll-viaduct for vehicular and other traffic in the City of Richmond, and in connection with the designing and construction of the said railway and viaduct, in case that the Company be successful in raising the necessary money.

The work of the Engineers is to be divided into three parts, viz.:

A.—A study of the project so as to determine the total cost of construction, the probable income from traffic of all kinds, and the probable cost of operation and maintenance; also the preparation of a report to the Company embodying the results of their investi-

gations, which report is to be put in proper shape for submission to capitalists in order to induce them to subscribe for the bonds and other securities of the Company.

B.—Aiding the officers or representatives of the Company in their interviews with capitalists and endeavoring in every legitimate way to help finance the enterprise.

C.—Doing the entire engineering work connected with the designing and construction of the proposed railway and viaduct, including inspection of viaduct metal at the rolling-mills and the shops, the operating machinery at the places where it is manufactured, and all other materials in the field, unless the Contractors elect to have any of such materials inspected elsewhere, in which case they shall be so inspected by the Engineers but at the Contractors' expense.

The Company is to pay the Engineers thus:

For the preliminary work and report, twenty-five hundred dollars (\$2,500.00).

For aiding in financing the project, nothing.

For designing, inspection, and superintendence of construction, a fee of five (5) per cent. of the grand total cost of the finished railway and viaduct, the division of the said fee being on the basis of three (3) per cent. for plans and specifications and two (2) per cent. for inspection and superintendence.

The Company is to do its best to secure from Richmond capitalists one-half of the money required for the entire enterprise.

If the report of the Engineers prove unfavorable, their contract with the Company is to be closed, and they are to be paid at once the twenty-five hundred dollars (\$2,500.00) mentioned; but if it should be favorable to the viaduct and unfavorable to the railroad, the Company is to endeavor to raise the money for the viaduct, and in case of its success the Engineers are to design, inspect, and supervise the construction of the said viaduct for five (5) per cent. of the entire cost of the finished structure.

In case that the Engineers' report prove favorable, but the Company fail to secure the necessary money and abandon the enterprise, the Engineers are to receive a further payment of one thousand dollars (\$1,000.00), and their contract is then to be terminated.

If, after the report is finished and the project is presented to capitalists, it develop that the scheme can be materialized only by the resignation of Winans & Jenkinson as engineers for the con-

struction of the railway and viaduct, they shall terminate their contract with the Company and shall receive for so doing a further payment of ten thousand dollars (\$10,000.00). But should they be retained on the viaduct and not on the railway, this ten-thousand-dollar (\$10,000.00) payment is to be reduced in the proportion that the estimated cost of the railway bears to the estimated cost of the railway and viaduct.

If, after the Company gives formal orders to the Engineers to proceed with the preparation of plans to submit to contractors for tendering, the project should be abandoned, the Engineers are to be paid in full for all work done up to date, plus one-half of the balance of their estimated total fee.

Draft the contract between the Company and the Engineers for the above "Conditions Precedent."

CASE NO. 2.

Viaduct

The Engineers of the Capital Rapid Transit Company (mentioned in Case No. 1) have prepared plans and specifications for the proposed viaduct and have called for bids thereon at schedule rates for excavation and for all the various materials in place, with the result that the Virginia Bridge Company, a corporation of the State of West Virginia, and having headquarters at Wheeling, W. Va., has submitted the most satisfactory tender, their bid being as follows:

For excavation, including back-filling, one dollar and sixty cents (\$1.60) per cubic yard.

For piles in place, sixty-two cents (62c.) per lineal foot, no allowance being made for the ends cut off.

For substructure concrete in place, nine dollars and forty cents (\$9.40) per cubic yard.

For superstructure metal (excluding hand-rails, railway rails and trolley-poles), erected and painted, four and two-tenths cents (4.2c.) per pound.

For reinforced concrete to support the pavement, exclusive of the reinforcing bars which are to be paid for as superstructure metal, ten dollars and fifty cents (\$10.50) per cubic yard.

For asphalt pavement, including a ten-year guarantee for repairs, one dollar and fifteen cents (\$1.15) per square yard.

For hand-rails in place, two dollars and thirty cents (\$2.30) per lineal foot of hand-rail.

For railway rails in place, including bonding, one dollar and twenty-five cents (\$1.25) per lineal foot of single track.

For drainage down-spouts in place, ten cents (10c.) per lineal foot of down-spout.

The trolley-poles and the trolley-line are not to be included in this contract.

The entire work is to be completed within seven (7) months from the date of signing the contract, under a forfeit of fifty dollars (\$50.00) per day, which forfeit has not been mentioned in the specifications that are to form a part of the contract.

The schedule prices to be adopted in making partial payments for all work as it progresses are to be determined by the Engineer.

The amount of bond required is forty thousand dollars (\$40,000.00).

Draft the contract between the Company and the Contractor for the preceding conditions.

CASE NO. 3.

The Kansas City Southwestern Railway Company, a corporation of the State of Missouri, being desirous of replacing four (4) old and seriously overloaded, single-track, steel spans of two hundred (200) feet each, at four (4) different places on the line of its road, has had four (4) new, riveted, through spans manufactured by the Pennsylvania Steel Company, all the metal for which spans, including an ample supply of rivets and pilot nuts for driving the pedestal pins, is to be delivered by April 15, 1906, at a certain point on the line of the Company's railway; and has had its Consulting Engineers call for bids for the erection of the said metal and for the furnishing and putting in place of the deck-timbers and for laying the rails that are furnished by the Railway Company, the Contractor having to furnish and put in place falsework strong enough to carry safely the passing trains, and having to take down, mark, and store the metal of the old spans. Replacing Bridge

The Central Bridge Company, of Kansas City, Mo., a corporation of the State of Missouri, made the most satisfactory tender, which was as follows:

For falsework in place, strong enough to carry safely the Company's trains, seven dollars and twenty-five cents (\$7.25) per lineal foot of structure.

For taking down, marking, and storing the metal of the old spans according to the directions of the Engineer, two dollars and eighty cents (\$2.80) per lineal foot of structure removed.

For erecting and painting the new metal-work of the superstructure, eight-tenths of a cent (0.8c.) per pound.

For furnishing and putting in place the timber for the decks, thirty-five dollars (\$35.00) per M. feet B. M.

For laying rails, fifteen cents (15c.) per lineal foot of single track.

Provided that the metal is delivered at the bridge-sites by May 1, 1906, the last of the four spans is to be completed and ready for traffic by October 1, 1906; and in case of delay in the delivering of the said metal, the time for completion is to be properly extended.

The Contractor will not be allowed to interfere with the passage of any passenger train more than one hour or with that of any freight train more than two (2) hours, unless special written permission to the contrary be given by the Company.

The schedule prices for partial payments on the work as it progresses are to be determined by the Engineer.

A bond of twenty-five thousand dollars (\$25,000.00) will be required as a guarantee that the Contractor will comply with all the requirements of the specifications and contract.

The forfeiture for non-completion of the work on time shall be fifty dollars (\$50.00) per day per span; but this forfeiture shall not be exercised by the Company unless the Engineer deem that such enforcement is just and called for by either the Contractor's wilful delay or the Company's actual loss.

Draft a contract between the Railway Company and the Contractor for the preceding conditions, taking special care to protect the Company against detention or wreckage of trains.

CASE NO. 4.

Promoters' Agreement

Two engineers of New York City, John Brown and James Smith, desire to enter into a contract to prosecute a general engineering practice, starting on January 1, 1907.

Brown is the better situated financially, consequently he is to advance ten thousand dollars (\$10,000.00) to the firm as a working capital and is to receive six (6) per cent. interest on it, but each year Smith must put one thousand dollars (\$1,000.00) of his share of the net earnings of the firm into the working fund, and Brown is to draw out annually a like amount until their two deposits are equalized, Brown receiving each year six per cent. on the excess of his deposit over that of Smith.

For the first year Brown is to receive seventy-five (75) per cent. of the total net profits and Smith twenty-five (25) per cent., and each year Brown's share is to decrease five (5) per cent. and Smith's is

to increase that amount until the division becomes equal. But should Smith fail for any year to deposit his one thousand dollars (\$1,000.00), no increase for that year will be allowed him; but the next year he shall have the privilege of depositing two thousand dollars (\$2,000.00) and receiving an increase of ten (10) per cent. In case of failure for two consecutive years to deposit the amount agreed upon, Smith shall not have the privilege of depositing three thousand dollars (\$3,000.00) at once and claiming an increase of fifteen (15) per cent., but the amount of his deposit at any one time shall be limited to two thousand dollars (\$2,000.00), and his corresponding increase in percentage shall be limited to ten (10). Should the business of the firm run so low in any year that Smith's share of the net profits is less than twelve hundred dollars (\$1,200.00), Brown out of his private funds shall pay Smith the difference between twelve hundred dollars (\$1,200.00) and Smith's said share.

At the outset the entire equipment of the office, valued at five thousand dollars (\$5,000.00), is to be furnished by Brown, and any additional equipment required from time to time is to be paid for out of the office earnings; and when the partnership is placed upon an equal basis, Smith shall pay Brown twenty-five hundred dollars (\$2,500.00), with interest thereon at six (6) per cent. from the date of the forming of the partnership until that of the equalization, after which Smith shall be a half-owner in all of the office equipment. Before the partnership is equalized Brown may dissolve it at any time by giving Smith six (6) months' notice in writing and paying him one thousand dollars (\$1,000.00) and his regular share of the net profits on all unfinished work, Smith having the option of taking at once in cash the amount of the said net profits as estimated by Brown or of waiting for the completion of the said unfinished work and receiving then his exact share of the said net profits.

Smith may terminate the contract at any time by giving Brown six (6) months' written notice and waiving all claim to profits on unfinished work; but should he fail to give the six months' notice, he is to pay Brown five hundred dollars (\$500.00) for his failure to do so.

In the event of the death of either of the partners, the survivor shall finish all business uncompleted at the time of the said death, and shall turn over to the estate of his deceased partner that partner's share of the net profits on such unfinished business, figured according to the rate of division ruling at the time of said death.

In case of Smith's death before the formation of the equal partnership his estate shall have no claim against Brown for any share of the office equipment; but in case that his death occur after the formation of the equal partnership Brown shall pay to his estate one-half of the value of the said outfit as appraised by three arbitrators.

In case of Brown's death before the formation of the equal partnership, Smith shall have the right to purchase the entire office equipment by paying to Brown's estate the sum of five thousand dollars (\$5,000.00); but if Brown's death occur after the formation of the equal partnership, Smith must pay to his estate one-half of the appraised value of the said equipment.

Draft the contract between the two partners upon the preceding basis.

CASE NO. 5.

Employment

Augustus Hurlburt, of Lexington, Mo., a man of some means, has conceived the idea of building a toll bridge over the Missouri River at his city, and desires to engage the services of Henry Jones, a civil engineer, of St. Louis, Mo., who makes a specialty of bridgework, to assist in the financing of the enterprise and to do all the engineering work required from start to finish. As Jones is without means, Hurlburt is to furnish all the cash required to materialize the project, but Jones is to receive no personal compensation until the enterprise is financed, after which he is to get a net fee of two and one-half (2.5) per cent. of the grand total cost of the entire structure, payable monthly proportionately to the value of the work done on actual construction. In addition to this he is to receive twenty (20) per cent. of whatever portion of the bridge Company's stock that Hurlburt has been able to retain in making his agreement with the capitalists.

Draft an agreement between the two parties on the above basis and define carefully what each party is to do from start to finish.

CASE NO. 6.

Promoter's Agreement

William Simpson, a promoter, has developed a project for building a concrete dam across Arapahoe Creek, in Colorado, and irrigating thereby a large tract of land. He has organized a stock company in Colorado and called it the Arapahoe Irrigation and Development Company, the amount of the capital stock, for the purpose of organization only, having been fixed at ten thousand dollars (\$10,000.00).

To build the dam and to purchase about one-half of the land to be irrigated will require cash to the amount of two million, five hundred thousand dollars (\$2,500,000.00), including a fair profit on the construction and purchase. He desires to expand his organization by increasing his capital stock to three million dollars (\$3,000,000.00), issuing bonds to that amount, and disposing of as many of these securities as is necessary to raise the two and one-half million dollars (\$2,500,000.00) in cash.

He takes the project to the New York bankers, Messrs. Fish & Robbins, who agree to undertake the underwriting of the bonds and to subscribe liberally themselves. The bonds are to bear five (5) per cent. interest, and the lowest figure at which they are to be sold is eighty-five cents (85c.) on the dollar. Fish & Robbins are to make a portion of their profit on the sale of the bonds at some higher figure than this. Simpson is to retain fifty-five (55) per cent. of the capital stock, and the remaining forty-five (45) per cent. is to be turned over to Fish & Robbins, who will part with as little as they can when getting the bonds underwritten, and will retain the balance as profit.

Fish & Robbins also agree to advance money at six (6) per cent. interest from time to time to Simpson up to a limit of three hundred thousand dollars (\$300,000.00), in order to enable him to carry on the work of construction and to make the first payments on lands purchased. For this loan they are to have a one-quarter interest in Simpson's profit on the purchase of land and construction of dam and irrigating ditches; for it is Simpson's intention to do all the construction himself and to purchase land that will lie under the ditch as cheaply as he can and turn it over to his Company at ten dollars (\$10.00) per acre. This arrangement is to be well understood in advance by all parties interested in the project. To the owners of the remaining land lying under the ditch the Company will later on sell water privileges at as high a price as it can obtain. The Company will begin by farming some of its own lands, and by leasing others to farmers, with the intention of ultimately selling all its lands at a great profit and furnishing water for them at a fair price.

The underwriters are to advance money on the bonds upon certificates of an engineer appointed by them to supervise the work, stating that certain lands have been purchased and paid for in full, and that actual work to the value of the amounts indicated has been done, including a proper profit for the Contractor. In other words,

the subscribers to the bonds will advance money only for an equivalent cash expenditure for work or land.

The entire engineering is to be done by and under the Engineer appointed by the underwriters; but the complete detailed plans and specifications are to be agreed to by Simpson, the Arapahoe Irrigation and Development Company, and the underwriters (through their Engineer and a special committee) before any money is advanced for construction or purchase.

Because of this arrangement Simpson will have to advance out of his own pocket whatever money is necessary for the preliminary engineering work and for the preparation of the plans and specifications; but the amount of such expenditure is to be refunded to him just as soon as the final contract is entered into between the Company and the underwriters. All engineering expenses are to be borne by the Company, and are to be considered a part of the construction expense.

Simpson is to be paid by the Company for his work at the following rates:

For the concrete foundations of dam below ordinary water-level, as determined in advance by the Engineer, including the necessary excavation and back-filling, twenty-two dollars (\$22.00) per cubic yard.

For the remaining concrete of the dam and for all other concrete work on the entire job, fourteen dollars (\$14.00) per cubic yard.

For cast-iron pipe in place, including the lead calking of the joints, five and two-tenths cents (5.2c.) per pound of pipe.

For steel gates and other steel constructions in place, six cents (6.0c.) per pound.

For timber of flumes, trestles, and other constructions in place, fifty-five dollars (\$55.00) per M. feet B. M.

For all earthwork, measured in excavation, excepting only the excavation for the base of the dam, thirty-three cents (33c.) per cubic yard, provided the haul does not exceed five hundred (500) feet.

For overhaul of earthwork, one cent per cubic yard for each one hundred (100) feet of haul exceeding five hundred (500) feet.

For all other materials or work not included in this list, actual cash cost, plus fifteen (15) per cent. for profit.

Upon the preceding hypotheses the student will please draft the following papers:

A.—Contract between Simpson and Fish & Robbins.

B.—Contract between Simpson and the Arapahoe Irrigation and Development Company.

C.—Contract between the Arapahoe Irrigation and Development Company and the underwriters.

CASE NO. 7.

Rufus Thompson, hydraulic engineer and contractor, of Minneapolis, Minn., has developed a project for building a complete system of water-supply and sewerage for the City of Hiawatha, Wis., and has entered into a provisional contract with that city, according to which it is to pay a certain lump sum for the sewerage system and certain hydrant rentals for city water, and is to give to the company that Mr. Thompson has organized the exclusive privilege for thirty (30) years of supplying the citizens of the said city of Hiawatha with water. The construction of the entire system of water-works and sewerage is to be subject to the inspection and acceptance of the City Engineer of Hiawatha, who will act as Consulting Engineer on the work.

Promoter's Agreement

A liberal estimate of the entire cash cost of the water-supply and sewerage systems proposed is one million, two hundred thousand dollars (\$1,200,000.00).

Mr. Thompson has already organized under the laws of the State of Wisconsin, for the sole purpose of materializing this project, the Hiawatha Water-Supply and Sewerage Company, the amount of the capital stock being fixed at first at twenty thousand dollars (\$20,000.00), with the intention of increasing it later to one million, five hundred thousand dollars (\$1,500,000.00) and bonding the property to a like amount.

Mr. Thompson has taken the project to the New York bankers, Solomon, Lowenstein & Co., who have agreed to underwrite the bonds to the amount of six hundred thousand dollars (\$600,000.00) and to assume the underwriting of the remainder. The bonds are to be sold to Solomon, Lowenstein & Co., at eighty-two cents (82c.) on the dollar, and they are to obtain as much higher a price as they can when dealing with the other underwriters. Solomon, Lowenstein & Co. are to part with as little as possible of the capital stock of the Company when dealing with the other underwriters, in no case giving more than forty dollars (\$40.00) in stock with each one hundred dollars (\$100.00) in bonds; but with their own purchase of six hundred thousand dollars (\$600,000.00) of bonds they are to receive three hundred thousand dollars (\$300,000.00) in stock.

After the entire bond issue has been subscribed, whatever stock has been left over is to be divided between Mr. Thompson and the bankers in the ratio of two-thirds ($\frac{2}{3}$) to the former and one-third ($\frac{1}{3}$) to the latter; but all the stock controlled by the said Thompson and the said bankers is to be pooled or held in trust for a term of ten (10) years, or until such a time as the Company has declared two (2) successive annual dividends of not less than six (6) per cent. on the entire capital stock.

The trustees for the pool are to be Mr. Thompson and Mr. Lowenstein, and their headquarters as trustees are to be in the New York office of Solomon, Lowenstein & Co.

Mr. Thompson is to be retained, if possible, as Chief Engineer of the enterprise, and is to be paid by the Company for his services and for those of his assistants in doing the entire engineering, inspection, and superintendence of construction five (5) per cent. of the total cost of the completed work, including right of way and all other legitimate items of expense.

Should, however, the services of Mr. Thompson be objectionable to the underwriters, who may desire to appoint an engineer of their own, Mr. Thompson is not to be made the Chief Engineer, but in lieu of such an appointment is to receive from Solomon, Lowenstein & Co. either twenty-five thousand dollars (\$25,000.00) in cash, or one hundred and twenty thousand dollars (\$120,000.00) in the stock of the Company, at his option.

Draft the contract between the promoter and the bankers upon the basis just indicated.

Draft also a contract between the Company and Mr. Thompson for the engineering work.

CASE NO. 8.

Ocean Pier

The Mexican Transcontinental Railway Company, a corporation of the Republic of Mexico, having headquarters at Mexico City, desires to let a contract for an ocean pier to be built in the harbor of Vera Cruz, Mexico, and has had prepared complete detail plans and specifications by its Consulting Engineers ready for both letting the contract and actual construction. The Consulting Engineers' estimated total cost of the finished structure, exclusive of the engineering fee, is two hundred and five thousand dollars (\$205,000.00).

Bids have been called for, but owing to the almost constant presence of yellow fever in Vera Cruz none of the bidders was will-

ing to name a lump sum for the work at all near the Engineers' estimate.

The lowest bidder was the Central Bridge Company, of Kansas City, Mo., who asked two hundred and sixty thousand dollars (\$260,000.00) for the work, but stated in their tender that they would be willing to undertake the contract at actual cash cost, plus twenty (20) per cent. for profit.

A conference between the Consulting Engineers and the proprietors of the bridge company resulted in the following compromise, which was submitted to the President of the Railway Company and accepted by him:

The Contractors are to furnish free of charge all the plant necessary to build the pier, and no allowance is to be made for either its use or for its deterioration while employed on the work; but the cost of the repairs to it during construction is to be considered as a portion of the cost of the work, and is to be allowed for in the Engineers' monthly estimates.

The Contractor is to be paid the actual cost of the entire work, including freight on materials and plant to Vera Cruz and freight on plant back to Kansas City, plus seventeen (17) per cent. on the said entire cost as profit, provided that the total amount of the said profit does not exceed thirty-two thousand dollars (\$32,000.00).

All items of labor, materials, transportation of men, materials, and plant between the United States and Vera Cruz, traveling expenses of the Contractors and of their salaried employees, insurance of every kind on men, plant, and materials that it is customary for American contractors to pay when doing similar work in foreign countries, stamps for documents, and taxes of all kinds shall be considered as legitimate expenses and shall be allowed by the Engineers. As the structure is located in the city, the workmen will have to find board and lodgings for themselves, unless the Contractors desire to house and board the men, which they are at liberty to do as their own private venture.

The Company will not allow any sick or incapacitated men to be kept on the pay-roll, except by written permission of the Engineers for men who have been hurt on the work and who are willing to waive in writing all claims for damages, provided they are kept on the pay-roll until well enough to resume work.

The Company will not pay for any medical attendance, medicine, or hospital charges for their Contractors or any of their employees; and on this account the Contractors are at liberty to enter into

contract with all the workmen whom they send from the United States, or with European or American workmen engaged in Mexico to insure them against illness (in any way that seems best to the Contractors) by deducting a certain fixed percentage from all the said workmen's wages; but this arrangement shall not apply in the case of Mexican workmen.

The decision as to what is and what is not "Plant" is to be left entirely to the Engineers, the intent being to class as materials for the work everything that is likely to be used up or expended thereon, and to class as plant that part of the Contractors' working outfit that will be worth returning to the United States after the pier is finished.

The Engineers' estimates are to be made in American money, but according to the laws of Mexico the Contractors' accounts must be kept in Mexican currency. The rate of exchange to be used by the Engineers in reducing Mexican to American currency shall be that ruling in the City of Mexico on the date of the estimate.

The number of men employed and their salaries or wages shall be subject to the approval of the Engineers, who shall also convince themselves of the men's fitness for the work.

The Engineers are to approve of the Contractors' plant before work is started, and shall order more to be supplied if subsequent developments show that it is necessary.

The Engineers are to approve of all materials purchased by the Contractors for use on the work; and all expense bills are to be vouchered before being presented for approval.

All pay-rolls are to be signed by the payees in the presence of a duly authorized representative of the Engineers, and two copies thereof are to be made and attested by a notary.

The Company shall not be held liable for the failure of the Contractors to comply with any of the Mexican laws, especially those relating to the stamping of documents.

Owing to the high rates charged by the casualty insurance companies on work done in Mexico, the Company will itself insure the Contractors against accidents, but the latter must report all casualties immediately in writing to the Engineers and to the President of the Company. Minor accidents are to be settled for as quickly as possible by the Contractors after consultation with the local representative of the Engineers and after receiving his approval; but no individual settlement exceeding two hundred dollars (\$200.00) in

gold shall be made without special written permission from the Company.

The Contractor is to provide a bond of fifty thousand dollars (\$50,000.00) gold; but the Company will allow the premium thereon to go into the Engineers' estimates as a part of the cost of the work.

Draft a contract between the Company and the Contractors to meet all the preceding conditions and any other conditions that ought to be covered in such a document.

CASE NO. 9.

Assuming the conditions given in the last case, draft a contract between the Engineers, Walters & Hendricks, of Philadelphia, and the Railway Company so as to cover all the peculiar conditions of the case, as well as all the usual conditions included in contracts for doing engineering work in the United States. Contract for Services

The payments to the Engineers are to be in American money as follows:

For complete detailed plans and specifications, six thousand dollars (\$6,000.00).

For inspection of metal-work at mills and shops and for supervising the loading of it on vessel and unloading it at Vera Cruz, also for the checking of shop-drawings, one dollar and fifty cents (\$1.50) per ton.

For supervision of construction in the field, the actual total cash cost thereof to the Engineers, including all the traveling expenses to and fro, plus a lump sum of two thousand dollars (\$2,000.00).

The pier to be designed is to be five hundred (500) feet long and seventy-five (75) feet wide.

The deck is to consist of six (6)-inch creosoted planks supported by rolled I-beam stringers and cross-girders resting on screw-piles. There are to be two railroad tracks at the middle of the structure extending over its whole length. The live load per square foot of floor is to be taken at four hundred (400) pounds.

CASE NO. 10.

Joseph Mason, a railroad contractor of Tombstone, Ariz., has conceived the project of building a railroad about ninety miles long to the Alvarado Mine, which has lately been opened and which shows great quantities of low-grade ore that would have to be transported to Tombstone on the way to a smelter. The line projected Syndicate

by Mason's reconnaissance would pass near several high-grade mines and several large ranches, from all of which business for the railroad could be obtained. In addition to this there would probably be other business from new mines that would undoubtedly be opened and from other ranches that would be located close to the railroad.

Mr. Mason has called in Adolf Macklin, a railroad engineer of Tombstone, and Arnold Potter, of Phoenix, Ariz., who has been successful in launching several large construction projects in that territory, to aid him in the materialization of the project.

These three parties constitute what may be termed the "Promotion Syndicate."

The arrangement between the members of the Syndicate is that Macklin is to survey the route, make plans, profile, estimate of cost, and complete specifications for letting the contract, and prepare a prospectus to submit to capitalists, all at the expense of Mason; but Macklin himself is to receive no salary.

A stock company is then to be formed at Mason's expense, the amount of the capital stock at the outset being limited to ten thousand dollars (\$10,000.00), consisting of one thousand (1,000) shares of ten dollars (\$10.00) each. With the exception of one share for each of the other incorporators of the Company, Mason is to hold in his own name all of the stock until the project is about to be financed, when other arrangements will be made.

After the Engineer's preliminary work is done, the members of the Syndicate are to determine a proper contract price per mile of road for building and equipping it complete, allowing an estimated profit of twenty (20) per cent.; and Mason is to take the contract for building the entire road at these figures after the necessary capital is raised.

Macklin is to have the contract for all the engineering work from start to finish, is to pay every expense connected therewith, and is to receive as his gross compensation one thousand dollars (\$1,000.00) per mile of main line and five hundred dollars (\$500.00) per mile for sidings and branch lines, provided that the project is materialized.

If it is, Macklin is to refund to Mason out of the engineering fee one-half of the total cost of the entire work involved in making the surveys, plans, profiles, estimates, and prospectus.

Potter is to make what commission he can out of the bankers. In dealing with the latter the Syndicate is to reserve for its members as much as possible of the capital stock, and what is saved is to be

divided among them on the basis of one-half ($\frac{1}{2}$) to Potter and one-quarter ($\frac{1}{4}$) each to Mason and Macklin.

As soon as everything is ready to submit to bankers, Potter and Macklin are to make a trip at Mason's expense to some of the principal money centers of the country, and are to use every legitimate endeavor to float the enterprise, and are to continue their work until either success is attained or the expenses of their trip amount to six thousand dollars (\$6,000.00), after which it is to be optional with Mason as to whether they shall continue their efforts or abandon the enterprise. If the latter be successful, Potter and Macklin must each refund to Mason one-third ($\frac{1}{3}$) of the total amount advanced by the latter for organizing the Company and financing the scheme.

Draft a contract among the three members of the Syndicate upon the preceding basis.

CASE NO. 11.

The Syndicate mentioned in Case No. 10 has been successful ^{Guaranty} in its efforts. Macklin found that twenty-four thousand dollars (\$24,000.00) per mile of main line, fifteen thousand dollars (\$15,000.00) per mile of branch line, and nine thousand dollars (\$9,000.00) per mile of siding would cover the entire cost of construction and equipment, and would allow a probable profit of twenty (20) per cent.; and Mason agreed to accept the contract at these rates.

In round figures the number of miles of main line proved to be ninety-two (92), the number of miles of branch lines nineteen (19), and the number of miles of sidings and terminal tracks ten (10).

The Tombstone Alvarado Railway Company was organized in Arizona as agreed upon, then Potter and Macklin went to New York, where, after great efforts, they succeeded in inducing the banking firm of Lieberman & Co. to underwrite the bonds. It was decided between the Bankers and the Syndicate to issue five (5) per cent. mortgage bonds to the amount of three and a half million dollars (\$3,500,000.00) and stock to a like amount. The Bankers were to take the bonds at eighty (80) cents on the dollar and were to receive sixty (60) per cent. of the capital stock.

They were to pay Potter a commission of ten (10) per cent. of their net profit on the sale of the bonds, but were not to give him any portion of their share of the stock.

The Bankers also agreed to advance money to Mason from time to time up to an amount of two hundred thousand dollars (\$200,000.00) to enable him to carry on the construction; because as usual the proceeds of the sale of the bonds were not available for payment to the Contractor until after certain amounts of work were finished and certified to by both the Company's Engineer and a supervising engineer appointed by the Bankers to see that the money be properly expended. For this accommodation the Bankers are to receive five (5) per cent. interest on the money advanced and ten (10) per cent. of the Contractor's net profit on the entire work, as shown by his books, which are always to be open to the inspection of the Bankers' representatives.

Draft a contract between the Bankers on the one hand and the Railway Company and the members of the Syndicate on the other, so as to embody all the pertinent conditions given in this case and in the preceding one.

Draft also the necessary contract between Mason, the Contractor, and the Tombstone Alvarado Railway Company, making the said Contractor give the Company a surety company bond to the amount of two hundred thousand dollars (\$200,000.00), guaranteeing the faithful performance of the work.

CASE NO. 12.

Bond

Referring to the last "Case," draft a contract between the contractor, Joseph Mason, and the North American Surety Company of New York City for the two hundred thousand dollar (\$200,000.00) bond required.

N. B.—It would be well for the student, before attempting this, to procure blank forms of bonds from two or three surety companies.

CASE NO. 13.

Copartnership

Two engineering firms of Pittsburg, Pa.—viz., Davis & Wilkinson, who make a specialty of electric railways, and Harris & Elmore, who make a specialty of bridgework—have concluded to join forces to do the entire engineering work on an important electric railway that is to be built from Pittsburg to a neighboring city, and that is to include an expensive bridge over the Monongahela River, besides a number of smaller bridges on the line.

Harris & Elmore are to attend to all the bridgework and Davis & Wilkinson to the balance of the engineering; but in order to save duplicating field parties, D. & W.'s employees are to supervise

the erection of the small bridges along the line at H. & E.'s expense.

The combined firms are to receive from the Railroad Company for their services a gross fee of five (5) per cent. of the total cost of construction, which fee is to be divided between the two firms according to the ratio that the cost of work done under the jurisdiction of each bears to the grand total cost of construction.

All payments on account to the combination are to be divided by these ratios, using the estimated total costs, irrespective of whether the said payments on account relate to bridgework or to other work.

It is understood that this combination of interests applies to this particular piece of construction only, and that the two firms are at liberty to do any other work they choose at the same time that the joint work is in progress, provided, however, that neither firm permits other business to interfere with the proper prosecution of the said joint work.

Draft the proper contract between the two firms.

CASE NO. 14.

The Government of British Columbia is about to call for bids upon the substructure of a large bridge to be built across the Fraser River. Armitage & Morris are an old-established firm of contractors who have executed great constructions in the Province of British Columbia, and have become wealthy thereby; but they have had no experience in sinking piers by open-dredging or in driving long piles by means of the water-jet. On this account they desire to associate with them for this special contract Mr. Beaupère, an engineer of experience in the contracting part of bridge construction, under the firm name Armitage, Morris, & Beaupère. Copartnership

They agree to pay him a salary of two hundred dollars (\$200.00) per month from start to finish and to give him besides a ten (10) per cent. interest in the net profits on the contract, providing that there are any net profits, his monthly salary being counted as a part of the expense of construction.

But if there are no net profits, Beaupère is not to stand any share of the loss on the contract.

Armitage & Morris are to turn in all the plant they have that can be used to advantage on the work, and are to purchase any additional plant that may prove to be necessary. When the contract is fulfilled, whatever remains of the said extra plant is to be

appraised by a party or parties agreed upon by the principals, and the value thereof thus determined is to be added to the figured profits on the work, the first cost of the new plant having been computed as a part of the cost of construction.

If, before the substructure of the bridge is completed, the Government decides to give the firm the contract for building the approaches to the bridge or any portion of them, Beaupère is to share in the profits on this additional work; but if the said approach work is awarded the firm after the substructure is finished and accepted by the Government's engineers, Beaupère is not to have any interest in the additional contract.

Should at any time Beaupère desire to drop out of the combination, he may do so by giving the other partners ten (10) days' notice, in which case he is to receive his salary in full to the date of his leaving, plus cash to the amount of his share of the estimated profit on the job up to that time, provided that the parties in interest can agree as to what is a proper estimate of the amount of the said profit. If they cannot so agree, the division of the profits is to be postponed until the completion of the entire work contracted for at the time of the dissolution of the special partnership, the amount of profit at the said time being prorated from the actual total profit in the proportion that the value of the entire work done up to the date of the Government Engineer's last monthly estimate bears to the total value of the construction as shown by his final estimate.

But should at any time Armitage & Morris desire to sever the special partnership, or in other words dispense with Beaupère's assistance, they can do so by giving him ten (10) days' notice and paying him an amount to be agreed upon by them all as a proper compensation in full. Failing such an agreement, Beaupère is to be paid his salary in full to the date of the sundering of relations; and after the contract is completed he is to receive his full share of the actual net profits, plus one-half of the remaining salary that he would have earned had he remained till the finishing of the work, the said salary being counted as cost of construction when the net profits are being computed.

In the event of the death of Beaupère before the contract is completed his salary shall immediately cease, and his estate shall be entitled to receive at once his share of the estimated profits up to the date of the last monthly estimate; and after the contract is finished one-half of the balance of his share of the actual total profit.

If an agreement cannot be reached as to the proper amount of estimated profit at the time of Beaupère's death, the settlement shall be postponed until after the entire work is finished and paid for; and in this case six (6) per cent. interest shall be allowed from the date of said death till the time of final settlement upon that portion of the profits finally determined to have been due at the said date of death.

In case of the death of either Armitage or Morris before the completion of the work, the executors or heirs of the deceased shall supply a competent man at their expense to complete the personal work of the deceased; and in consequence the division of profits of the special partnership will not be affected by such a demise.

If both Armitage and Morris should die before the completion of the work, their executors or heirs must supply at their expense competent substitutes to do the personal work of the deceased; and at the time of final settlement of the affairs of the special partnership Beaupère shall receive twenty (20) instead of ten (10) per cent. of the total net profits, the increase being allowed as compensation for the extra work and responsibility devolving upon him because of the death of the two partners.

Draft a contract between the old firm and Beaupère embodying all the preceding conditions and establishing the new temporary partnership.



Notes on the Law of Contracts.

An Appendix to Waddell's Specifications and Contracts.

By John Cassan Wait, M. C. E., LL. B.

Introduction.—Dr. Waddell has presented in the foregoing pages a practical synopsis of the subject of Engineering Specifications and Contracts, which, if carefully studied and applied to the cases presented, will, I believe, result in very great benefit to students of engineering and architecture. He has first taken up the subject of specifications, they being more directly the work of the engineer or architect, being the subject-matter of the contract and therefore reasonably requiring to be created, developed and described before being made the subject of a contract. The specifications are also more within the purview and understanding of the student of engineering or architecture than is the contract, and they are therefore properly the subject of prior study and practice.

SPECIFICATIONS.

1. *Contract Embodies Specifications and Plans.*—The specifications are not strictly an independent document to be distinguished from the contract, but they are a component part of the contract, the part descriptive of the structure and of the labor and materials comprising it. If the specifications and plans are independent printed or written documents, then they should either be fastened to or bound with the contract, or they should be referred to in the contract and identified either by description or by the signature of the parties. The plans are mere graphic specifications, an abbreviated form of illustrating and specifying dimensions and details of construction. The specifications should embody the plans, and they together should contain a full and complete description of the materials and work to be furnished and of the structure to be erected. They should contain all the dimensions, instructions and

directions necessary to secure the result to be accomplished. The description of materials should be made by such tests and comparisons that if two contractors have work upon adjoining sections with but an imaginary plane between them, the section engineers respectively would and must arrive at the same result, whether it be one of measurement or one of classification.

2. *Contents of Specifications.*—The specifications and plans should definitely describe the site of the structure, the crude stock and the process of manufacture of the materials and the finished materials of construction, not only positively as to good properties that they shall possess, but negatively, naming defects that they shall not contain. They should provide for inspection and tests at the mills and shops and for field inspection during erection, and every class of work should be described in sufficient detail to enable the builder to erect and complete the structure without further direction or explanation from the engineer or superintendent. Specifications and plans so prepared would be ideal, and every student of engineering should at least endeavor to make his specifications and plans ideal.

3. *What are the Specifications.*—The specifications may consist of a printed book with the signature of the architect and engineer and the approval of numerous officials of a company or of a government, or it may consist merely of a letter written, or of a mere sketch which describes the materials and methods to be employed. Drawings exhibited to a contractor when a contract is signed, if referred to in the contract so as to be identified, become a part of the contract; likewise, an act of the legislature or of Congress may be made a part of a contract by reference. So plans, profiles and drawings may become a part of an act of the legislature, but if the act itself does not refer to them they cannot be thereafter used in construing the act.

Frequently specifications or plans are referred to as signed or attached, when in fact they have not been signed or attached. In such cases oral evidence may be introduced to show what specifications were intended. If they can be identified, then they are in legal effect incorporated into the contract.

4. *Specifications to be Created.*—Contracts are sometimes drawn requiring structures to be built according to general plans and specifications, with the provision that the work shall be erected and completed in accordance with drawings, directions and instructions to be prepared or furnished by the architect or engineer. Such practice frequently results in controversy and disagreements be-

tween the engineer and the contractor, and it may well be doubted if the contractor would be bound to execute work in accordance with plans and specifications that differed materially from those furnished to the contractor when he entered into the contract, and which materially changed the cost of the work. Ordinances and regulations referred to in a contract become a part thereof, and will hold, not only as to the manner in which the work shall be done, but also as to how it shall be paid for.

5. *Limits of the Work to be Defined.*—Specifications should show the limits and boundaries of work, not only as to their area but as to the depth of the foundations and sub-structures. Much litigation would be avoided if provision was made, either by unit measure or otherwise, to compensate a contractor for the additional and increased depth that excavations and foundations are required to be carried to to secure good foundations. Frequently plans show a depth to which foundations shall be carried, and the specifications provide that the excavation shall be carried and the foundation built to such depth as shall be satisfactory to the engineer or architect. If the sub-soil be found poor, the engineer and architect shall take it upon themselves to require the foundations to be sunk to greater depth, to the great loss and damage of the contractor or builder. Such practice leads to unhappiness and litigation, and could easily be avoided to the advantage of both the owner and the contractor by limiting the extent of the work vertically as well as horizontally. The limits of work are defined or shown upon the plans by boundary or dividing lines; whatever is required outside or beyond such limits is extra work, for which additional compensation may be claimed by the contractor.

6. *Working Drawings at Variance with General Plans.*—When bids have been made and accepted on original plans and specifications, and the working drawings afterwards furnished vary from the original plans, involving much additional work, the contractor may refuse to continue the work at the contract price. That he should do, notwithstanding the owner employs others to do the work at an increased compensation, for the contractor may recover for the work he has done if the variance between the original and the working drawings be material. If, however, the contractor performs the work without protest, he very likely will be held to have done the work under his contract and at the contract price or prices.

7. *Conflict of Specifications and Plans with Express Terms of the Contract.*—If the terms of the contract do not agree with the specifications, they are said to be in conflict, and the question is,

"What was the intention of the parties as set forth in the instrument taken as a whole?" The whole question is, "What was the intention of the parties?" That must be determined from a consideration of the entire contract, including the covenants, the specifications and the plans. If the intention be legal, it will control, i.e., if not incompatible with the rules and maxims of the law, the mutual intention will prevail, and this is "the polar star" in the interpretation of all contracts. To arrive at the intention the Court will, so far as possible, put itself in the position and situation of the parties at the time the contract was executed. The conduct of the parties and the practical interpretation which they have themselves given to the terms of the contract, will have its influence, if the intention be not clear as expressed. If the contract and specifications do not agree with the working drawings and the work has been done under the direction of the engineer, according to a plan, model or sample furnished, the practical construction which the parties have adopted will prevail over the literal meaning of the contract and specifications.

8. *Contract the Superior Instrument.*—Other things being equal, the contract, being the more solemn instrument, is usually held to prevail over the specifications. This is because the contract is usually the more ceremonious undertaking and it usually defines the obligations assumed by the parties. It is the culminating act by which the parties bind themselves, and it is less often subject to alteration. On the other hand, the specifications and plans are descriptive of the work and the manner in which it is to be performed, and they are frequently subject to changes and alterations as new conditions and changed circumstances attending the performance of the work may arise. There might be reasons why either the specifications or the plans should prevail one over the other, depending upon the character of the conflict. The contract or the specifications would prevail over the plans only because and for the reason that the circumstances attending any case would lead the Court to give greater weight to the contract or specifications, because it more clearly and fairly expressed the intention of the parties. If there were any attending circumstances that indicated with sufficient certainty that the parties intended that the plans should control, the Court would be bound so to interpret the intention of the parties; thus the plans, the proposal, the specifications or the contract may prevail.

9. *All Parts will be Reconciled if Possible.*—If the Court can find a construction or interpretation that will harmonize with both,

or all of the several parts of the contract, viz., the plans, specifications and covenants, it will adopt that meaning. The meaning which is consistent with all parts. Therefore, when specifications required walls to be vaulted, and the plans showed them to be 16 inches in width without vaulting or spaces, it was held that the walls were to be 16 inches including the vaulting, and that evidence would not be admitted to explain the contract. So, when specifications required walls to be plastered with K. & Co.'s cement under the direction of the Superintendent of K. & Co., and the specifications also required that cement and sand should be mixed in equal parts, it was held that effect should be given to each requirement by holding that the Superintendent's powers extended to the laying of the cement plaster and that the contractor was bound by the proportions named in the specifications and that the contractor could not change the proportions even though the Superintendent did consent to it.

10. *Construction against Party using Language.*—Another point of law to be considered in the interpretation of clauses which are in conflict, is that the courts will usually construe the terms most strongly against the party who first used them or who prepared the contract. This rule of construction is generally applied, *except* where the government or the public are the parties, in which case it is usually held that the meaning will be adopted which is most favorable to the government or public, the courts holding that the interests of the public should be protected, because there is, presumably, nobody who has the interest in public welfare that he has in his own.

11. *Written and Printed Matter, and Punctuation.*—If in the contract or specifications the written portion of the contract is repugnant to the printed part, it is the general rule that the printed part must yield to the written, as the latter is presumed to be deliberately expressed in the written portion of the contract and subsequent to the printed portion. To have any part of a contract control another part, it must be inconsistent or opposed to it. If the two parts can be reconciled, the Court is bound to do so. Therefore, when the printed part provided that payments should be made on the architect's certificate, and the written part provided that the payments should be made at fixed stages in the progress of the work and at a stated time after its completion, it was held that there was no inconsistency between them and that neither part would be rendered inoperative. In interpreting contracts or legal documents, punctuation has very little weight. The want of a punc-

tuation mark or the misplacing of one will not be allowed to vitiate the contract or destroy its meaning any more than bad grammar or bad spelling.

12. *Work According to Specifications or as a First-Class Job.*—

When work is to be performed in a good and thoroughly workmanlike manner and at the same time according to specifications and plans, the question arises as to whether the contractor is excused from making a first-class job if he completes his contract in accordance with the specifications and plans. An undertaking to construct a piece of work is an undertaking to do it well and in a workmanlike manner, even though it be not expressly stipulated; but if the owner or his architect or engineer specifies materials, workmanship or the manner in which the structure is to be erected, and if after completion it proves to be defective and does not fulfill the purposes for which it was intended, then the fault lies with and the loss falls upon the owner. This was so held when the owner required a contractor to follow his directions in making an experimental article from a pattern furnished. The owner was required to pay, even though the article was not fit for the uses contemplated.

13. *Implied Warranty of Work.*—Whoever undertakes to erect a structure, impliedly warrants that he is reasonably skilful in his trade or calling and that the materials he uses should be suitable for the purposes for which they are used. A builder has been held liable for a defective chimney which would not carry off the smoke, for which it was designed. The fact that the price paid was grossly inadequate does not excuse the builder from fulfilling his undertaking to do a thoroughly workmanlike job. When one has agreed to execute a job in a plain and workmanlike manner, or in a manner to be determined by the engineer, it has been held that he is bound to show that he executed the work in a plain and workmanlike manner. The courts sometimes hold that the provision that the work should be substantial and workmanlike was an additional safeguard to insure a satisfactory completion of the work; that while substantial and workmanlike did not imply a perfect job, yet it was a question of fact for the jury to determine if the work complied with the contract, and was not a question for the court. It has been held that the work should be perfectly done for the character of the job contemplated. It has also been held that the expression cannot be overcome by showing the custom or usage which allowed the use of inferior materials or unskilful work.

14. *Owner Warrants Sufficiency of Plans, When.*—Work done

strictly according to plans and specifications furnished and adopted by the owner is done and completed at the risk of the owner, unless the contractor has either expressly or impliedly undertaken to warrant the sufficiency and stability of the work. When work has been completed in accordance with plans and specifications and under the direction and to the satisfaction of the architect, and the structure collapses, the contractor is not liable if he has furnished skilled labor and good materials and if the failure was due to defective and insufficient plans. The same has been held of a machine that would not work when completed; of a building that settled and cracked because the footing stones were too small as specified by the architect; and where an arch fell because it would not sustain the load imposed upon it. The contractor, to escape liability, must have completed his work in a workmanlike manner and must have employed good materials and must have done his work in a thorough and substantial manner, and he must prove that the structure failed because of inherent defects of the plans and specifications.

15. *Contract Entire, for a Completed Structure.*—Some courts have distinguished those cases in which the builder is merely to build according to plans and specifications, from those cases in which he is completely to furnish and deliver the structure ready for use. Some of the courts held that if a contractor has undertaken to deliver a structure complete, his undertaking is a warranty that the plans and specifications are sufficient, and that by assuming the obligation to complete and deliver a finished structure, the contractor approved and adopted the plans and specifications furnished by the owner. This has been so held where a building settled owing to latent conditions of the soil. The courts held that the contractor having agreed completely to finish the building, fit for use and occupation, he was bound by his covenant. In another case, where the contractor was to construct a well for a certain sum, according to specifications which called for a curb of certain shape and size, to be made of timber and planking of a prescribed size and quantity, it was held that the contractor could not recover for work and materials lost by the caving of the well before completion, notwithstanding that the failure was due to weakness of the curb specified. When the contractor warrants that the structure will answer the purposes for which it was intended, or that the machine will work, he will not be relieved from such warranty because the plans or specifications are defective.

16. *Undertaking to Build Implies Understanding of Plans, etc.*
—An undertaking to erect a structure according to certain plans

and specifications implies an understanding of them on the part of the contractor or builder, and the law will not permit him to escape liability for the failure of the structure on the ground that he exercised ordinary care and skill to understand and carry out the plans and specifications. If the contractor departs from the working drawings which are part of the contract, he becomes a warrantor of the strength and safety of the structure, unless the material deviations from the plans are made with consent or by order of the owner.

17. *Specifications against Engineer's Decision and Instruction.*

—It is usually provided that work, labor and materials shall conform strictly to the specifications and plans, and also that the directions and instructions of the engineer, as given from time to time during the progress of the work, shall be strictly followed, and sometimes in addition thereto that the work shall conform to the working drawings and directions given from time to time by the engineer or architect, and that the whole structure shall be completed to the acceptance and satisfaction of the engineer. Sometimes the specifications and plans are prepared at the general offices of the railroad, municipality or company, and the resident engineer or engineer in charge may not agree that the same properly fit or satisfy the conditions or circumstances arising during construction, and the latter establishes his own personal standard of excellence to which the work shall conform, and the question is, Which shall prevail—the specifications or the resident engineer? In this case we return again to the polar star in the exposition of instruments, and determine, if possible, what was the intention of the parties.

18. *Engineer's Powers Defined in Contract.*—The engineer's powers and duties are limited to those which the contract expressly confers or may be fairly implied from its terms. He cannot go beyond or behind it. His decision must relate exclusively to matters embraced within the agreement to submit to his directions and determinations. His decisions are conclusive only with regard to work described in the contract and specifications. He must measure and classify the work and materials according to the rules and tests named by the parties in the specifications. Even though he be sole judge of the work, its quality and character, he cannot accept what the contract forbids nor demand what the contract does not require. He must accept those things which meet the requirements of the specifications, and work and materials may not be accepted because they are as good or as suitable for the purpose without

the consent or acquiescence of the parties themselves. Neither the owner nor the contractor will be bound by the acceptance of the engineer, unless the work and materials conform to the contract requirements, even if they be accepted in good faith or under an erroneous view of the contract. So far as the contract and specifications show an evident intention to limit the engineer's discretion and to fix or name the quality of the work, so far must he follow the specifications.

19. *Engineer's Duty to Follow Specifications.*—The first duty of an engineer is to require that the work conform to the specifications. That done, he may exercise his discretion and good judgment. He may not accept a brick house for one of marble, even though the brick house is substantially as good or even better than the one of marble. He cannot accept bluestone for brownstone, nor a 12-inch wall for a 16-inch wall, nor Bessemer steel for open-hearth steel. When the specifications require mortar to be of equal parts of cement and sand, a different mixture cannot be authorized by the engineer. When work and materials are required to be strictly according to specifications, and the engineer is also to accept and approve the work finally, and the contractor has completed a structure strictly in accordance with the plans and specifications, must the engineer approve and accept? In this, as in all cases of conflict, it is the question of *intention*. To determine that the court will consider every part of the contract and it will put itself in the shoes of the parties, consider their relations and the conditions and circumstances under which the contract was made and under which the work had to be done. The court will consider the interpretation which the parties themselves have adopted. Generally, when work is to be completed according to specifications and to the acceptance and satisfaction of the engineer, and the specifications describe the work and materials in detail, it is sufficient to complete the work as specified. Such a performance should be to the reasonable satisfaction and acceptance of the engineer.

20. *Engineer's Acceptance Additional Safeguard.*—This has been so held, but the courts have sometimes held that the requirements that the work should be to the acceptance and satisfaction of the engineer was an additional safeguard. When the engineer's decision is final and the engineer has signified his acceptance and approval, it will bind the owner even though there has not been a material compliance with the specifications; but the engineer must have acted in good faith. If work has been completed according

to the specifications and plans and the engineer refuses his acceptance and approval, it is, to say the least, *evidence* of bad faith. If the working drawings furnished by the engineer differ from the original plans and specifications in material respects, and the contractor has agreed to perform the work according to detail drawings to be prepared and directions to be given by the engineer, he can be required to do so and without extra remuneration; but it is submitted that the working drawings and directions must conform reasonably with the original plans and specifications.

21. *Work and Materials Rejected by Engineer.*—Frequently the specifications require that materials and work may be rejected by the engineer and inspector, if, in their opinion, they do not conform strictly to the specifications. If work and materials do conform to the specifications and are rejected by the inspectors or engineers, the question arises as to which will control and to what extent the power of the engineer in rejecting or accepting materials will bind the contractor or the owner. If the engineer has been given the full power of an arbitrator or an umpire, and his conclusion is made final and conclusive upon the parties, it is well settled in England and in many of the United States that his decision will control. If he accept inferior or defective materials, the owner must pay for them, and if he reject good and substantial materials the contractor must supply other better materials. This rule requires that the contractor shall secure the acceptance of materials before using the same. If materials are rejected the engineer must be specific in describing the defects, so that the contractor can remedy them. A notice to a contractor that certain parts of a structure are "worthless and dangerous, not fit for use, liable to cause damage, and their construction in direct violation of the contract," without specification of the nature of the alleged defects, has been held insufficient to require a contractor to replace such parts or to defeat his right to recovery.

When a certain kind of stone was specified and was used upon the work and it was afterwards found defective, the contractor recovered the contract price, it not being shown that the defect was in the workmanship. The same has been held of sand used which was particularly described and designated. If a builder give notice of the poor quality of materials, and the work is carried on under the eyes of the owner, he may not refuse to pay for the work because the structure is so affected by the weather as to prove worthless. The use of brick made of inferior clay, in good faith, by the contractor, the defective condition not being discov-

ered by careful inspection, but developing only after exposure to the weather, will not defeat the contractor's right to recover. So, too, when the owner specifies certain brands of materials or a manufactured product by the trade name, and then arbitrarily confines the contractor to such materials, the owner takes the responsibility of any inherent defects which may develop subsequently and which are not discovered under ordinary inspection.

22. *Defective Work and Materials Accepted by Engineers.*—

If engineers or inspectors are clothed with authority to construe and determine the meaning of the specifications and the plans, and have the power to accept or reject materials and workmanship, and the structure has been accepted and the contract fully executed, and no fraud has been practiced by the contractor, it is well settled that the owner or company can have no recovery against the contractor for defective work or materials. It was held when excavations and foundations were to be made for a structure under the instruction and to the approval of an architect, that the contract was performed whether the work had been done in conformity to the drawings or not. It was held that when machinery for a steamboat was required to be of the best material throughout and of first-class workmanship, subject to the inspection of the company's superintendent, who had the right to reject anything not equal to the requirements of the contract, and every facility was afforded the inspector to inspect the work and materials, that the company could not recover from the contractor for injuries resulting from the failure of the steamboat. Likewise it has been held that a contract to construct a wharf according to plans and specifications furnished by the company, who saw the work during its progress and until completion, that no recovery could be had from the contractor because the structure was defective and injuries resulted. The same has been held of a bridge erected and completed pursuant to the directions of an engineer in substantial compliance with the plans.

23. *Acceptance of Structure.*—The above cases are cases where the decision of the engineer or architect had been made binding upon the parties to the contract. It has been held that, if such be not the case, his acceptance of inferior materials will not bind the owner nor relieve the contractor from performing his agreement in strict compliance with the contract. It has also been held that the work must have been accepted in order to conclude the owner; that the payment of progress certificates did not constitute a waiver of defects in quality which were not apparent from inspection.

If the contractor be subject to the direction of the engineer in charge and his decision is made final and conclusive, and the quality of materials furnished and the manner of doing the work are specified, the contractor is not responsible for defects of the work as a whole, if he has complied with the architect's direction. The engineer's failure, however, to object when work does not conform to the contract and specifications, does not show acquiescence in such work or in the use of parts or members of a structure which are smaller or of different dimensions than those specified in the contract.

When it is provided that the materials shall be strictly in accordance with the plans and specifications, and that a person appointed shall inspect and accept such materials as he may deem proper, it has been held that a difference of opinion between the contractor and the inspector, as to whether or not the materials conformed to the plans and specifications, was an incident contemplated by the terms of the contract, and that the rejection of materials in good faith by the inspector gave no ground for damages to the contractor, even though the rejected material did conform to the specifications and plans.

24. *Contract must be Construed as a Whole.*—Whether or not the specifications or the determination of the engineer shall control must be determined from the whole contract, and the stipulations granting such powers must be read in the light of the rest of the contract, and the powers of the engineer must be exercised in accordance with the understanding of the parties as outlined in the contract. Much is often left to the engineer's discretion and judgment, but so far as the contract and specifications show an evident intention to limit the engineer's discretion and to fix the quality and character of the work and its execution, so far will the engineer be bound to follow the specifications and the plans. His duty is first to determine the conformity of things with the specifications and the requirements of the contract, and as to the rest, to consult his own discretion and good judgment. He must decide whether work has been executed in a manner and to a degree of perfection promised or demanded in the contract. He cannot dispense with the performance of a substantial part of the work; he may decide whether work has been executed in a workmanlike manner, if the materials are the kind required; but it cannot be contended that the engineer can accept something unlike that which is called for, even though it is substantially built and for all practical purposes as

good or even better than the structure specified in the contract. However conclusive the engineer's decision may be made, or however closely the contractor is to follow his instructions in all things, that will not justify a departure from the express terms of the contract. An acceptance by the engineer of a different class of work or of inferior materials will not bind the owner, nor will it relieve the contractor from his agreement to perform according to plans and specifications.

25. *Conflict Between Specifications and the Judgment of the Contractor.*—Frequently the contractor is made responsible for the maintenance and repair of work and for its stability, and at the same time he is also required to follow the specifications and plans. The question arises as to how far the contractor must follow the plans and specifications when in his best judgment the work will not be stable or meet the requirements as to maintenance, strength and durability. Here, as in other cases, it is a question of *intention*. The courts will look to the instruments to determine the intent. In such cases the question is, "Does the contractor warrant that the specifications and plans are sufficient to effect such a result as he will be able and willing to maintain for the purposes intended, and for the period named?" Suppose, for instance, a contractor undertakes to build a bridge in accordance with the specifications, plans and directions of an engineer, and the engineer directs what foundations shall be built, under the protest of the contractor "that said foundations are insufficient and will not support the structure." Suppose the foundations are built according to the orders and directions of the engineer, and the structure fails. Is the contractor liable to reconstruct the foundations and the structure, or will the owner be required to pay for the work done in the manner required? Such a case is usually determined by deciding first if the contractor was to build and furnish *a completed structure*, or only to furnish work and materials for the structure. The courts distinguish an undertaking to provide and furnish a complete structure from one to furnish work and materials at a unit measure, or those cases where different kinds of work are parceled out to several different contractors. If a completed structure is to be furnished, then a contractor is usually held liable to build and deliver over such a complete structure and to be responsible for the maintenance and repair of a structure for a definite period; and the courts hold that the contractor adopts and approves the plans and specifications by which the structure is to be built. This again brings up the subject of liability for a structure whose failure is due to defective or

insufficient plans, and what has been said on that subject will apply here.

26. *Conflict of Specifications with Work and Materials Furnished by the Co-Contractors.*—Sometimes work done by other contractors does not comply with the specifications, and the stability, strength or durability of the structure may depend upon such condition. If a post-contractor has warranted the stability, strength or durability of the structure, the question arises if he should make the defective work good. The economy and quality of the painter's work often depend upon the work done by the carpenter, and the masonry work often depends on the stonecutter's work, and the stability of a building may depend upon the foundations put in by a prior contractor, and the success and satisfactory completion of almost any job depends in a degree on the skilful performance of work by other contractors or material men. Frequently the question arises in doing masonry work as to who shall furnish the centers for the arches; whether the mason or the carpenter shall supply them. The obligation of each contractor is usually an obligation to the owner, and there are no relations between the several contractors except such as are created in the contract. If, therefore, one contractor is under no obligations to another contractor, his obligation lies to the owner. His only remedy, therefore, for defective work is against the owner, and it therefore becomes the obligation of the owner to enforce contract obligations against each and every contractor. If the owner does not enforce such obligations and if he does not require that each shall do his work skilfully and completely, then *he should be held liable* to other contractors for any damages which they may suffer by reason of the acts of co-contractors or material men.

Sometimes the owner himself is to furnish the materials for certain parts of the work. If the owner is to furnish the materials, as the steel and iron for a frame structure, and the contractor is to forge, assemble and rivet such materials into a complete structure, and the materials do not conform to the specifications, the question arises whether the contractor is liable for the failure of the structure and if the contractor has not waived his rights by failing to protest against the use of inferior materials.

27. *Work to Specifications and Satisfaction of Owner.*—When work is to be completed to the satisfaction of the owner or employer, and specifications have been prepared, or a certain result is to be obtained which has been defined and described, and the work has been completed according to such specifications or in such a manner

as to accomplish the result, the question arises if the owner *must* be satisfied. If the contractor has covenanted to do the work and to satisfy the owner, he cannot be said to have fulfilled his contract until he has *satisfied* his employer. *But*, the owner might unreasonably, unfairly and fraudulently refuse to declare his satisfaction, and thus defeat the contractor from recovering for his labor and materials. This the law will not allow, especially if the structure be erected upon the land of the owner or employer and to his benefit and cannot be removed. It would be unreasonable and unjust if the contractor should be denied a recovery for the reasonable value of his work and materials, or at least for so much as he has *benefited* the owner or employer. The law, or the court, therefore implies a contract and imposes upon the owner a promise to pay to the contractor so much as he has been benefited.

When, however, the labor and materials have been wrought into a chattel or an article which can be retained or returned to the contractor, a different rule has been adopted. If the owner declare himself dissatisfied and return the chattel to the contractor, it has been held that no recovery could be had, the contractor having failed to perform his obligation to please or *satisfy* his employer. When the work or materials have been incorporated into a bridge or a house, which by virtue of its permanent character has become attached to the land of the owner, the courts hold that if the work has been done according to the plans and specifications prepared and submitted by the owner, it should and must be to his reasonable satisfaction, and that therefore he must recompense the contractor. The courts hold in such cases that the work need be completed only to the owner's reasonable satisfaction. When, therefore, a contractor was to receive for a public work "whatever the board might allow as right and proper," it was held that the contractor could sue for his reasonable compensation, even though the board had tendered to him what it considered right and proper; and when an employee was to be paid whatever he saw fit to charge, it was held he could not make his charge unreasonable.

The owner's dissatisfaction must be in good faith, and he can take into consideration only the performance of the terms of the contract. He may not require materials not contracted for, and his privilege must be exercised in a reasonable manner; not arbitrarily nor capriciously, for the purpose of defeating the contractor's recovery.

28. *Application of Specifications to Extra Work.*—A provision that is often omitted in contracts and which is at times of impor-

tance, is one that requires extra work, or "extras," to conform to the specifications and plans. Extra work, strictly, is work outside of and not included in the contract. Clauses which require materials and work to be done to the engineer's acceptance have been frequently and generally held not to apply to extra work. Fortunately, the question is not often raised, because it is a foregone conclusion among contractors and engineers that when the intention is manifest in the contract to require good, substantial work and to employ materials of good quality and make, and that the job or structure shall conform throughout to good workmanship, it is a natural inference that the specifications for such work shall apply to the *extra* materials and work, and this would be a reasonable construction for the courts to apply; but the courts do not imply warranties as to stability, strength and durability to extra work not mentioned and provided for in the contract and specifications.

This fact, however, does not excuse the contractor for doing or furnishing extra work and materials that are defective and not suitable to the purposes for which they are intended. The general presumption of law that "an undertaking to furnish materials and do work requires the contractor to furnish such as shall accomplish the purpose for which they are intended," applies as well to extra work undertaken as it does to general work. Therefore, when in the construction of a house a contractor is asked to build the foundations and walls of a cistern, and he uses the same proportions of cement, sand and stone for concrete as was used in the foundations of the building, it has been held that he is liable for the defective and leaky condition of the cistern, and can not excuse his failure to make it tight by explaining that he has followed the contract and specifications in making concrete for the cistern. If the work had been done under the eyes of the inspectors and architect and with their knowledge and approval, it is doubtful if the contractor would have been held liable for the defective condition of the cistern.

29. *General Rules of Construction.*—Throughout the discussion and application of these rules or decisions, it should be constantly borne in mind that in all cases of conflict it is a question of *intention* of the parties which will be determined by the court after a due and proper consideration of all the terms of the contract and specifications, and the circumstances surrounding the parties at the time they entered into the contract, and of the practical construction which the parties themselves have placed upon the con-

tract during its performance. The intention ascertained, it will prevail in all cases.

30. *Relative Length of Parts of Contract.*—In connection with this the relative length of the contract and specifications has been the subject of much discussion in engineering and architectural circles. It is really of little or no importance, and the question should be determined by the universal rule that all legal documents should be made as brief and as clear as is possible. The length of the contract or the specifications should be determined solely and entirely by the detail and care with which the parties and their engineer define their intention, and that will depend largely upon their ability to use good, pure English. The *intention* should first be determined, and then it should be clearly, plainly and briefly expressed. If the engineer be painstaking, conscientious and given to detail, the specifications will be very lengthy, and if he *who* prepares the contract be concise and confident, his character will be reflected in the contract, and it will be proportionately abbreviated. It will depend largely upon the personal equation and the experience of the party who prepares the instrument.

31. *When the Intention is not Expressed.*—The *intention* of the parties should be fully expressed. If it be not, then the parties are likely to be bound by what is known as custom and usage, or the common practice, and this may not be what the owner or the engineers contemplated. The constant struggle between contractors and engineers, the former to have a good and workman-like job and the latter to have a superior and exceptional piece of work, keeps the standard of excellence low. Custom and usage when the specifications are not definite would probably be determined by the contractor, the builder and the mechanics who work for and under him, which would make the standard probably inferior to what the owner and the engineer want. Unfortunately, engineers are not so ready and willing to assist one another in establishing a high standard of work, nor have jurymen so much confidence in the theoretical training of engineers as they have in the ordinary practical mechanic who is a layman like themselves and who has their sympathy. Jurymen are likely to be tradesmen, mechanics and material men, who favor contractors in the recovery for materials and labor which they have bestowed upon structures, and the benefit of which the owner has had and keeps. In such cases contractors have a superior advantage when they seek to recover for work which they have done or for materials which they have supplied.

It therefore behooves the engineer, whose duty it is not only to protect the interests of his employer, the owner, but also to do justice to the contractor, to draw his specifications and to make his plans with extreme care, so that his *intention* may not be misunderstood, even though the parties endeavor to misconstrue them.

32. *Specifications and Plans should Provide for a Result.*—Specifications and plans should provide for a result or a completed structure. They should not aim merely to secure the supply of materials and labor. They should be so complete as to require nothing from the engineer or architect but a fair interpretation and explanation, and which, among persons familiar with the kind or character of work which is described, can reasonably receive but *one interpretation*. If the specifications be not complete and do not embody such direction and control as shall fix and determine fully what the contractor is to do and how it is to be done, and the owner or his engineer or architect is required to assume direction and control of the contractor and his employees, then the contractor ceases to be an independent contractor, and he and his employees become the servants of the owner, who may be held responsible for their acts or negligence. Such relations of the parties are to be avoided, as it is one of the principal objects in letting work to contractors to avoid the responsibility due to the acts and negligence of the contractor and his servants. It is a well-established principle of law that the owner cannot reserve the control and direction of the contractor without assuming the responsibility for his acts. It is therefore recommended that the contract shall not bestow the direction or control on the engineer, but that the specifications and plans shall so clearly and explicitly define what is required of the contractor that the engineer or architect shall only have to define and interpret such specifications and plans. To accomplish this, the engineer is usually given the power to interpret and explain the plans and specifications, as where there are apparent omissions or conflict between the several parts of the specifications themselves or between the specifications or the plans and the contract.

33. *Dividing Work among Several Contractors.*—In the preparation of specifications a word might be said as to the practice, particularly of architects, of letting work, as that of the erection of a building, to several contractors, as to a mason contractor, a carpenter, a plasterer, a plumber, an electrician and an ornamental iron-worker. This practice the author deplores, and congratulates the engineering profession that it has not fallen into this practice, which he regards as an evil. Such a contract puts it within the

power of the several contractors to get in one another's way, to damage and destroy one another's work and generally to delay the ultimate completion of the building. Engineers sometimes divide the subject-matter of a contract into several independent stages, with good results. The foundation of a structure may be provided and furnished by one contractor and the superstructure by another, as for a bridge or even for a building. So, frequently, the grading, the foundations for structures, the track and bridges and buildings of a railroad may be profitably and reasonably let in four or five contracts; but they are contracts which mark separate stages of the progress of the work, where the several contractors are not upon or in charge of the work at the same time, and where they will not interfere one with another or destroy one another's work. Two excuses are usually made for subdividing the work of a structure, as a building, among several tradesmen or foremen-mechanics; one, that it saves to the owner the contractor's profit; and two, that it enables the owner or architect to select the best master mechanics for the different branches of the work undertaken. It is the author's experience that the owner does not secure either the advantage promised or the saving hoped for. Master mechanics will not generally give to owners the low prices that they will to employing contractors, and it will frequently be found that the selection of master mechanics is made by the architect, who sometimes, at least, profits indirectly and unknown to the employer, he having his favorites among mechanics and material men, which favoritism is sometimes cultivated to the extent of receiving commissions, engaging in business enterprises and accepting gratuities wholly unknown to the employer or owner. Another objection is that the owner is deprived of the knowledge and experience of an employing contractor, who looks at the situation from the standpoint and with the eye of all the trades employed upon the job, while the practice of dividing it up into numerous contracts and among the several tradesmen or master mechanics gives to the owner only the separate and individual views and experiences of the several mechanics or tradesmen.

34. *Work at Cost plus a Percentage or a Fixed Sum.*—Of late years much work has been undertaken and done at a price denominated cost-plus-a-fixed-sum or cost-plus-a-percentage, an example of which contract is furnished, introducing many conditions and circumstances attending such an undertaking. If the owner and the engineer have explicit confidence in the contractor or superintendent who undertakes the work, such a practice is, without doubt,

the fairest and best for both the owner and the contractor. It avoids paying extraordinary prices to insure contingencies, accidents and misfortunes which the contractor will certainly make a part of his contract prices, and it gives to the owner a lower percentage of profit in consideration of his assuming the risks than the contractor would be content with if he assumed the risks of the work. On the other hand, the contractor is relieved of the anxiety and unforeseen obstructions and the extraordinary conditions attending the foundations and the ordinary risks of nature, as well as of labor and other organizations.

Such a plan, however, with the dishonest contractor would be a burden to an owner or employer. Unfortunately, a practice has grown up among contractors, manufacturers and material men of secretly allowing and paying commissions to sub-contractors, agents, and even engineers, by which the actual cost of work, with the usual trade discounts, may be increased from 5 to 25 per cent. If a contractor were so disposed, he could fairly prove the actual cost of the work much more than it would be if he gave to the owner the benefits of low prices and discounts to which he is ordinarily entitled. Owners sometimes seek to meet sharp practices of dishonest contractors by paying the bills for materials and the pay-rolls for labor themselves directly, but this does not obviate the evil practice, as the system of rebates is in vogue among contractors, material men and manufacturers, as well as between manufacturers and transportation companies. With a competent, honest and conscientious superintendent or contractor in charge of work, the system of cost-plus-a-fixed-sum, or cost-plus-a-percentage of the cost, has, without doubt, very many advantages, and usually results in great economy to the owner. This is especially true in new construction, such as armored or reinforced concrete, at the present day. The percentages or commissions paid to contractors under such contracts vary from $2\frac{1}{2}$ to 15 per cent., depending upon the character and size of the work.

CONTRACTS.

35. *Contracts; Subdivisions, Covenants and Specifications.*—Two things usually determine the subdividing of the Contract into covenants and specifications. One, a desire to prepare a general form of contract which may be used throughout the various departments or bureaus and which shall be serviceable and apply to any and all structures undertaken; another is the desire to have the specifications contain and embody all those things and matters

which pertain to the actual, physical construction, erection and completion of the work. The latter form is usually adopted for individual pieces of work or for similar structures, of which several are to be built under different contracts. In either case, the Contract will usually contain the general covenants pertaining to the liability of the contractor, the consideration for his undertaking, the manner, time and method of payment, provisions covering liability for accidents, negligence and for default or delay on the part of the contractor or the owner. The contract will also contain provisions against subletting, the filing of liens and the failure to make payments for claims of material, men and laborers. It will provide for notices and contain those provisions required by statute laws of the state or the charter of the municipality, such as those providing for compliance with the labor law, the lien law, the giving of bonds, the filing of the contract, the compliance with ordinances and laws for the safety of the public, and police regulations. The contract should also contain the description of the parties, their residence, domicile, and the laws under which they exist. The contract should also contain references to such other instruments, ordinances and franchises as are intended to be made part of the contract, including the specifications, plans and special acts of the legislature or other public body under and by virtue of which the contract is made and carried out. If the contract be prepared for several bureaus or departments, and the several structures or pieces of work which are to be undertaken under it are authorized by separate acts of the legislature or of the board of aldermen, then these special authorizations are better embodied and made a part of the specifications which describe and specify the particular public improvement or work which has been authorized. In fact, in such cases it were better that all matters, provisions and stipulations pertaining to a particular piece of work should be embodied in the particular description of that work, which is the specifications. It is bad practice to repeat clauses and provisions in the several parts of the same instrument, unless they be made in the same language and applied to the same structure and to the same circumstances and conditions in each instrument, as such a practice leads to confusion and conflict which may be detrimental to the interests of either party.

36. *Extra or Additional Work.*—Extra or additional work is the contractor's aim and the owner's fear. Drastic provisions are written and inserted in contracts to avoid additional or extra work, especially where the contractor is to furnish for a lump-sum price a

completed structure. Contractors sometimes take work for the fair and reasonable cost thereof, without profit, in anticipation that the extras of the job, at handsome prices, will afford them their profits. This is especially true where contracts are let after competitive bidding. The usual provision is that no allowances or payments will be made on account of any additional or extra work, unless the same be ordered in writing by the owner and the price agreed upon at the time or before the work is begun, and that monthly statements shall be rendered of such extra work, under the title thereof, by the contractor to the owner. Provisions are written utterly precluding a contractor from any recovery whatever for furnishing such extra work or materials, unless said provisions are strictly complied with. When such contract clauses are inserted, controversies frequently arise between the engineer and the contractor as to what is or is not extra or additional work. The architect and owner refuse to give such a written order or to determine the value of work done before it is undertaken. As a result, this extra or additional work is one of the chief sources of litigation between contractors and owners; and it usually arises from the failure to properly and sufficiently describe the work to be done by the contractor, or from overbearing conduct of engineers and architects who are not willing to acknowledge that they inadvertently overlooked certain items of labor or materials which are required to complete the subject matter of the contract, or that they made mistakes in establishing lines and grades or in designing the work.

Usually, if the work done by the contractor is strictly extra work and outside of the contract and specifications and plans, the courts permit him to recover for the same, even though no written order was made, no price agreed upon and no account rendered. This is usually allowed from the fact that the owner knew or ought to have known that the work was being done, and that silence under such circumstances gives consent.

37. *Character of Extra Work.*—Provisions for extra or additional work should be drawn with extreme care, and only after the specifications have been prepared, revised and reviewed, and after the engineer is satisfied that he has fully described all the work contemplated by the contract. The intention should be as clear as to what is comprised in the undertaking. Controversies over extra work are the chief source of litigation in construction contracts.

Of the various kinds of extra work there might be mentioned that due to omissions from the specifications; that required to make

alterations and changes and additions, as to meet the conditions of the soil or circumstances unforeseen and discovered during the progress of the work; that required to correct the mistakes and errors of the engineer, his assistants and inspectors, such as errors or alinement, grade and measurement; that required for experimentation by the engineer or architect, as the adoption of new methods or new materials; that required to renew or replace damaged work, whether from action of the elements, act of God or from insufficient plans, and that required to extend work to secure greater stability, strength or durability.

38. *Alterations Affecting the Validity of a Contract.*—It is a good practice to provide that alterations and changes made in a contract shall not affect its validity. The courts have held that when contracts are substantially altered and in material respects, the contract may be held to be abandoned. It is therefore good practice to provide that alterations made during progress of construction shall not destroy the binding effect of the contract, so far as it is applicable. As a rule it is good practice, when material alterations, additions or omissions are made, to have that the subject of a supplemental contract duly signed by the parties. This obviates any question as to the effect that they may have upon the original contract and leaves the situation clear and unmistakable.

39. *Time of Essence—Delay.*—In almost all construction contracts *time is of essence*—i. e., the structure is required to be completed in a definite period of time. Delays are among the greatest misfortunes attending construction work. The delay in the completion of a comparatively unimportant structure on the line of a railroad or other public utility, may tie up hundreds of thousands or even millions of dollars' worth of property and render it practically useless. It is absolutely essential that the various parts of a public improvement or a great work should be completed contemporaneously, so that they may be utilized in their respective places. Contracts are therefore drawn to avoid delays even of short periods, and almost every device known is employed to secure absolutely the performance of a contract within a stated time. Forfeitures, penalties and liquidated damages, bonds and clauses of abrogation and cancellation of the most drastic character are inserted in construction contracts to insure the most supreme effort on the part of the contractor to complete the work within the time named. On the other hand, on the part of the contractor, he seeks to have clauses relieving him from such covenants in case of labor strikes, riots and internal strife that are beyond his control. Manufacturers and

supply men who have a monopoly of the goods which *they* manufacture, insert such conditions relieving *them* from damages for delays caused by conditions beyond their control, and the poor contractor or master mechanic is in the position of being "between his Satanic Majesty and the deep blue sea." He is required absolutely and unconditionally to perform the terms of his contract with the owner, and he cannot, even by paying extraordinary prices, secure the same terms with the monopolistic material men and manufacturers. Add to this the troubles that arise with labor organizations, and the contractor is in a position not to be envied by the most optimistic business man. It is such circumstances that frequently cause the insolvency of some of the largest contractors and builders. The drafting of clauses that will secure the completion of structures absolutely, and at the same time be fair and reasonable as between the owner and the contractor, is one of the most difficult of any that the engineers are called upon to prepare. Other things should be considered than the financial interests of the company or owner, viz., whether or not a fair-minded business man would undertake absolutely to furnish the materials and erect a structure complete within a certain, definite time, when he knows absolutely that it is impossible to get a contract with the steel or bridge companies for materials with which the structure is to be erected. The entering into such contracts by builders and contractors is sometimes an act that makes lawyers and engineers question their sanity or good faith.

40. *Abrogation or Cancellation of Contract.*—It is frequently provided that in the event of delay or certain defaults upon the part of the contractor, the owner may abrogate or cancel the contract and complete the work himself at the expense of the contractor; and that he may retain any moneys due and owing to the contractor for that purpose. This is an essential clause in a contract where the contractor is given possession of the land or the structure by license or lease from the owner, as the contractor in his unhappiness might tie up indefinitely the work and prolong the construction of it almost indefinitely. To meet such a situation without the clause, the owner would have to assert himself forcibly, and would very likely find himself very much in the minority with his engineers and household servants, while the contractor would be surrounded by his superintendent, foremen and an army of employees, part of whom might be the most desperate characters known to the community. The author has known instances where the owner has attempted to abrogate or cancel the contract and to shut out the

contractor from the works, when the contractor has forcibly taken possession, proceeded with and completed the work, and then sued to recover the full contract price. Such a practice, however, is unusual, and the provocation must be great that would prompt a contractor or builder to assume such an undertaking. Usually the failure or refusal to pay the contractor in progress payments, as promised, is sufficient for him to abandon the work; but when the owner does that he then subjects himself to a countersuit for damages for breach of his contract.

41. *Abrogation Contingent on Engineer's Certificate.*—Usually abrogation clauses are made dependent upon a certificate of the engineer that in his judgment the contractor has unreasonably delayed the work or has failed and refused to fulfill in accordance with the contract terms; and the right to abrogate or cancel the contract is made dependent upon such a certificate by the engineer. This may seem unreasonable and unfair, especially where the engineer is in the employ of the owner, but it is absolutely necessary to have the abrogation dependent upon some act which can be taken positively and unequivocally, and so as to define and determine the right of the owner to abrogate without any question as to whether or not the contractor has or has not fulfilled.

If the engineer or architect act unreasonably and fraudulently, the contractor has his remedy in court, as the Halls of Justice are always open to any claimant who can show fraud and collusion between the owner and his agents, architect or engineer. If the engineer unreasonably and arbitrarily and in bad faith give such certificate, or makes a decision against the interests of the contractor, he has but to show evidence of such fraud and bad faith sufficient to satisfy a jury that the conduct of the engineer was reprehensible or unfair, and he may recover whatever damages he has suffered by reason of such conduct, and usually from the owner who employs the engineer or architect; sometimes from the engineer or the architect himself.

A contract should not be abrogated or cancelled except as a last resort, but in granting a contractor indulgences and permitting him to do things forbidden by the contract, and which are sufficient grounds for cancellation, the owner or the engineer or architect should make it perfectly clear by correspondence, or by declaration before witnesses, that the act or indulgence shall not be taken as a waiver of the right to cancel the contract or as a condonation of the conduct of the contractor.

42. *Waiver of Contract Clauses.*—This brings up a subject

which is very important throughout the performance of a contract, and especially in the administration of the engineer's or architect's duties. If a contract provides that payments shall be made in a certain way and upon certain conditions precedent, and they are made without regard to such events or conditions precedent not once alone but several times, the owner, engineer and architect may be held to have *waived* the express provisions of the contract, and they may become what is known as a "dead letter." Great care should be taken to follow strictly the terms and requirements of a contract, lest the parties, the contractor as well as the owner, be held to have waived certain conditions and to have modified the contract by the acceptance or adoption of other terms changing or even contradicting the express written terms of the contract. If a contractor submits to a construction or interpretation of provisions of a contract that are against his interests, and performs the work in accordance therewith, even though complaining, but without making sufficient protest, he may not thereafter claim and recover for such work, injuries or damages, but will be held to have *waived* the express provisions of the contract and to have acquiesced in the construction adopted or insisted upon by the engineer. Want of knowledge of this principle of the law causes great hardships to the contractor or the owner, who, in the belief that he has a written contract defining his rights, continues to expend labor and materials upon a job, or consents to things being done upon a structure, in the belief that the fair meaning of his contract will be upheld in court; and who afterward finds upon consulting a competent attorney, or when he gets into court at trial, that he has acquiesced and waived the express provisions of his contract to his detriment and loss. Engineers and architects in their desire to be fair and sometimes to even assist a contractor by making the contract terms easier, as sometimes by making payments ahead of time, commit their employer to a practice which is contrary to the express terms of their agreement and which works great mischief, not only by establishing a waiver of such terms, but also, sometimes, by effecting a discharge and release of the contractor's sureties.

43. *Effect of Indulgences.*—There are so many results not anticipated to the layman that result from indulgences and from a failure to insist upon the full and complete performance of contract terms, that the author would impress upon students of engineering and architecture that they should not consider themselves at liberty to relieve the contractor from the full performance of the contract, *to the letter*, unless the same be submitted to the owner or to his

attorney as to the effect of such indulgences, omissions, alterations and changes. The responsibilities will then be placed where they belong, and the engineer or architect will not come in for condemnation when trouble arises in consequence thereof.

44. *Release of Sureties.*—Sureties or bondsmen who have signed a bond conditioned upon the performance of certain things in accordance with the contract and specifications, have a right to insist that the owner shall perform his part of such contracts at the times and in the manner and spirit, in the contract provided. If material changes are made in the contract or material obligations assumed by the contractor are changed or the burden thereof increased, or if the owner does not perform his obligations and exercise all reasonable precautions for the protection of the surety, then the bondsmen may be released and discharged from their obligation to the owner. It should therefore appeal to the engineer that the utmost care should be exercised in the making of payments, in the furnishing of materials and in making material changes, that they shall not in any way affect the bondsmen, or that the surety's consent be obtained before such payments are made or changes effected. It is not necessary that such changes in the contract terms should be to the detriment of the sureties; if they be material changes and be even to the benefit of the sureties, the bondsmen may, nevertheless, be released and discharged.

45. *Penalties vs. Liquidated Damages.*—The practice of inserting clauses providing for penalties, forfeitures or liquidated damages is one that has been carried to gross excess. There is no excuse for such a provision in a contract unless actual damages will be suffered, and unless, furthermore, the damage *cannot* fairly and reasonably be determined. Either party who assumes contract obligations is liable for the failure or refusal to carry out and fulfill the same, and in the amount of damages actually suffered; and the party who first commits a substantial default is liable to the other for the damages which he may suffer. A substantial breach by one party authorizes the other party to take advantage of the breach and to refuse further to perform his part of the contract. If, however, he continue in the performance of the contract, he may be held to have *waived or condoned* the first or primary breach by the other party. In such case it is often necessary to give notice to the party who has first committed a breach, that while you permit him to continue with the contract and while you continue to fulfill and perform your part of the contract, you do not *waive or condone* the first offense or breach.

The courts are uniformly against the enforcement of contract clauses providing for penalties, forfeitures and even liquidated damages. If the contractor can show that the owner did not suffer any damages, or that the damages which he suffered are materially less than stipulated in the contract as liquidated damages, the courts are likely to refuse to enforce a clause for liquidated damages and to grant the owner only such damages as he has actually suffered. The courts will not enforce penalties or forfeitures in any case. It is therefore desirable always to avoid the words "penalties" and "forfeitures," and to expressly declare that the amount stipulated is liquidated damages and not penalties and forfeitures. If an amount be stated as liquidated damages for the breach of a contract, the owner will usually be limited to that amount, even though his actual damages are several times as much. The clause therefore works both ways, against the interests of the owner as well as to protect him. If the amount named be made so great as to provide for any and every breach, then it will be so greatly in excess of one or a few breaches by the contractor that the courts will regard it so unreasonable and burdensome that they will refuse to enforce it, and will give to the owner only the actual damages that he may prove that he suffered by reason of the one or several breaches by the contractor. The use of a clause providing for liquidated damages is excusable only in those instances or cases where the amount of damages *cannot* be determined or assessed.

46. *Indemnity Clauses.*—A contract for the erection and completion of a structure or works should not be turned into a policy of insurance. It has been the practice to make a contractor liable for damages or injuries to persons and property resulting from his operations in the erection of structures; also to make him liable for acts or negligence of himself and his employees. Ordinarily, such indemnity should be limited to the wilful, negligent and malicious acts of the contractor, and he should not be required to indemnify the owner for misfortunes, injuries or damages to the person or property of other people, which are the natural result of the undertaking, and which could not reasonably have been avoided by the exercise of due care and diligence on the part of the contractor. Of course, it may be the intention of the owner and engineer to make the contract one of insurance or indemnity at all hazards and in any case. If such be the intention, it should be made clear and the contractor should so understand it.

Under the general clause making the contractor liable for the misconduct and negligence of himself and his employees, engineers

and their employers have undertaken to shift upon the contractor damages and injuries of every kind and from whatever cause. Thus, in the erection of an elevated railroad over a trolley line, the railroad company has sought to hold the construction company for damages which it suffered by causing the death of one of the employees of the contractor, which resulted from the operation of its trains—*i.e.*, by running them too fast; and a municipality has endeavored to hold a contractor responsible for damages to a mill-owner resulting from depriving him of sewage water taken from a stream by an intercepting sewer built for the municipality. The damages complained of in the latter case were caused not by the negligence or misconduct of the contractor, but by the fact that the sewer was built at all, and the courts held that the municipality only was responsible and not the contractor.

If construction contracts be drawn so as to provide for insurance of all the risks that may arise during the construction, and so as to assume responsibility for the results of the erection, completion and operation of the works undertaken, it may be expected that insurance premiums will be added to the contract price of the contractor, and that the premium rates will be in excess of that charged for marine insurance. It is the feeling of the writer that a construction agreement should not be made a contract for insurance.

47. *Subletting and Assignment of Moneys Earned.*—Contracts usually provide against the subletting of work without the consent of the owner or engineer. They also sometimes forbid the assignment of moneys earned or to be earned. If the contract forbids the subletting of the contract or parts thereof to other master mechanics or contractors, the performance of the contract *may not* be sublet to other persons; but, generally speaking, a provision forbidding the assignment of moneys earned or to be earned (in the absence of a statute to the contrary as to wages) is not binding upon the parties, as it prevents the transfer of property rights of the contractor. This has been held to be so even when an act of the legislature forbids the assignment of moneys earned under a contract for a public improvement. It has also been held that such provisions do not forbid the employment of sub-contractors or master mechanics in the several trades to do the work for and on behalf of the contractor, especially where the contractor is a general contractor and known to be such at the time the contract was entered into. Some courts have treated these clauses of contracts forbidding subletting with more or less indifference, unless the owner had and showed some good and sufficient reason for refusing his

consent to the subletting, on the ground that the contractor was responsible for the performance and completion of his contract, and for the further reason that in the event of death or disability, it could and would very likely be performed and completed by his executor or administrator, who might be anybody mentioned in the will or designated by the Surrogate.

In the case of contracts for personal or professional services, a contrary rule would prevail if the contractor be selected on account of his peculiar qualifications and special skill to erect, say, a lighthouse. In such a case it is doubtful if the contract could be assigned or sublet, or if it would descend to his executors and administrators upon his death. Contracts for professional services, as those of an architect, engineer, attorney or physician, are not assignable and cannot, against the wishes of the owner or employer, be continued and completed by the legal representatives of the professional man.

48. *Arbitration or Engineer's Decision.*—Dr. Waddell's belief in arbitration is not shared by the writer in construction contracts. The writer's experience with contract clauses providing for arbitration is that in nine cases out of ten, when controversies have arisen, one or the other of the parties will refuse to carry out the provisions for arbitration. This they may do with impunity, as there is no means of compelling them, under the ordinary provisions of the contract, to carry out the terms of the submission to arbitration; and they may, without generally subjecting themselves to any damages whatever, decline either to appoint arbitrators or to attend an arbitration. If, however, they do take part and the award be made and served upon the parties, they are irrevocably bound by such an arbitration. The trouble is and *will be* that they will refuse to either appoint arbitrators or to attend or take any part whatever; or one of the parties will seek to limit the scope of the arbitration to those matters and things in which he feels the stronger, eliminating and refusing to arbitrate matters which are apparently against him.

Owing to this fact the use of the arbitration clause might as well be omitted, as the parties, if willing to arbitrate, can at any time come to terms of an arbitration for the settlement of their controversies, and the use of the clause under the circumstances deceives and misguides the contractor and sometimes the owner in the belief that he can require the other party to submit their differences to a board of arbitrators to be selected in accordance with the terms of the contract.

49. *Arbitration Defeated.*—The general form of contract approved by the American Institute of Architects and the National Association of Builders contains a clause similar to that given in the text, and of some twelve or more cases that have come to the notice of the writer, in only one have the parties consented to and carried out the provisions for arbitration. In fact, it may be taken as the rule, rather than the exception, that the owner will not carry out the provisions for arbitration, and if he do he will insist that the questions to be submitted be limited, or that the arbitrators be selected from the legal, architectural or engineering profession, so that the contractor will be outclassed, if not prejudiced. This declaration is made after ten years' active experience in such cases. It is believed that there is no more danger of injustice in submitting questions of construction to the absolute determination of a civil engineer than there is in submitting it to the determination of a judge, who may be as subject to influence as is the engineer, and generally I believe that contractors, if they conduct their operations in a fair, conscientious and skilful manner, will be better treated and get more justice at the hands of a competent, experienced civil engineer than they will at the hands of twelve ignorant jurymen. The influence of blood, caste, politics, religion and secret societies upon the different units of a court, are just as likely to affect the recovery of a contractor in court as is the personal bias of the engineer of the field or office; and the practice, which has grown up in the centuries of experience, of leaving construction matters to the determination of the engineer, is one that should be respected and not dispensed with for the reason that it is autocratic. What should be done among engineers and architects is to establish and maintain such a standard of practice and of judicial determination as shall command the respect and consideration of all contractors and builders, and the dishonest, disreputable engineer or architect deserves any fate that may overtake him. He is quite unfit to exist in a civilized community.

An arbitration which requires the employment of three representative men of a community or of professional life is an expensive tribunal to determine ordinary questions of engineering contracts. The expense of providing the arbitrators, added to that of the stenographer at professional prices, is sufficient to deter the average owner or contractor from proceeding with an arbitration, even though he may have agreed to it inadvertently in the contract, not knowing the extraordinary expense attending it. Trials at courts are practically without expense to the litigants, except the employ-

ment of attorneys and the expense incident to providing witnesses, experts, etc. This is expensive enough.

50. *Appeal to Single Arbitrator.*—A practice that is gaining favor is to make an appeal from the engineer in charge of the work to some distinguished, high-class engineer or other person familiar with the work, and who has no personal acquaintance with either the engineer or the architect in charge or with either party, and to leave the determination of question in dispute to his *sole* determination. Such a practice is much less expensive, and by it the parties secure the knowledge, experience and superior insight of a professional man who, having no interest whatever in the matter and not even an acquaintance with the parties, would be most likely to determine the matter fairly and without prejudice. If such a party be named in the contract when it is entered into and his determination be made final and conclusive, instead of the employee of the owner, then there can be no failure of the arbitration, and the parties, when the subject is submitted by the engineer in charge to the arbitrator, will be conclusively bound by his decision and award. Such an arbitrator need not necessarily be the foremost engineer of the continent nor a leading light in the societies, but a man whose experience in the particular line of work would specially qualify him to determine the questions at issue.

Neither party to an arbitration can appeal from the decision of the arbitrators when it is once made and communicated to the parties. No appeal can be had by either party to the courts, unless gross fraud and collusion are shown between the arbitrators and one of the parties or the engineer and architect. The award by arbitrators is final and conclusive upon the parties, without appeal, if the award was fairly and honestly made.

51. *Engineer's Decision as to Extras and Additional Work.*—Extra work has been defined as work outside of the contract. A contract is supposed to apply to the work described therein, and the terms of a contract cannot by implication be extended to apply to anything except the structure, work and materials described. If, therefore, it is intended that the engineer or arbitrator should pass upon, inspect, accept and reject extra work, the contract should specially provide therefor; otherwise his decision will not be final and binding upon the contractor as to such extra and additional work. The omission of this clause is one of the serious mistakes of engineers and architects in the preparation of contracts.

52. *Laws of what Place Govern.*—It is well known that the laws differ in the different states and territories. The laws of

contracts are practically the same throughout the United States and in the British possessions, but many laws which determine the rights and liabilities under contracts vary greatly in different localities. Some states have what are known as statutes of frauds, which determine the form and conditions under which binding contracts may be made and concluded; also statutes of limitations, which limit the time within which obligations are required to be enforced by action in the courts. There are also lien laws and labor laws which affect the contract and which differ in the various states, territories and possessions of the United States. Therefore, what laws apply to the contract? Generally, laws pertaining to the legality and enforcement of the contract will depend upon the laws of the place where it is made, and the laws pertaining to labor, liens and legal rights of the parties will depend upon the place where it is to be performed and enforced. These matters should always be taken into consideration in the preparation of a contract, and they usually require the advice of an attorney-at-law who is familiar with the laws respectively where the contract is made and where it is to be performed, and with the laws of the domicile of the respective parties.

53. *Corporate Power to do Business.*—Another important matter to be considered, where either of the parties is a corporation and the work is to be in a state or locality other than the domicile of the corporation, is to determine that said corporation is entitled to do business in the locality where the work is to be performed. For instance, if a Jersey or Maryland corporation goes to the State of New York and undertakes the erection and completion of a structure, and it enters upon the performance of the contract without securing from the Secretary of State the necessary license and certificate to do business, the said corporation cannot enforce its claims in the courts of the State of New York, nor can it collect in its courts from the persons or corporations doing business in the State of New York under license any of the moneys earned in the performance of the whole or any part of the said contract. This is true in the State of New York, even though the contractor corporation obtains, subsequent to undertaking the work, a license to do business within the State of New York, and the courts have gone so far as to hold that the foreign corporation doing business in the State of New York without a license cannot assign the claim accruing to it from the doing of business in the said state to a third party, with the right to sue and recover the said claim. This is a very grave hardship to a foreign corporation, and it is a matter that

is comparatively new in the statute laws of our states, and it therefore behooves the engineer who prepares contracts for foreign corporations to see that said corporations are licensed to do business in the territory where the contract is to be performed and fulfilled, lest the money be expended, the work done and the materials furnished, with grave doubts as to a recovery therefor.

This is an example of what may result from engineers and laymen preparing contracts and undertaking to do business without the necessary guidance, counsel and advice of a well-informed attorney-at-law, and it is but one of many instances of serious loss resulting from a desire to economize, in what to good business men are necessary expenditures in the conduct of any business—viz., legal supervision.

54. *Other Legislative Restrictions.*—Restrictions are likewise imposed frequently by the legislature upon municipal corporations, including school districts and boards of education. They are frequently restricted in their powers to contract, and require certain forms and certain ceremonies to be followed before a valid contract can be made and entered into. One restriction most familiar is that of advertising and awarding a contract to the lowest bidder after public competition, and another is that the undertaking should be founded upon petitions of abutting property-owners, and another that it should be authorized by resolution of the board of aldermen or city council after public notice and hearings. Other requirements are that the contract should be approved by the corporation counsel, and that money should be appropriated and certified by the financial officer of the municipality or of the state. When these conditions are made conditions precedent to the making and entering into of a contract by the government, state or municipality, it is absolutely necessary that they should be strictly followed, to the letter of the law, lest they be declared by the courts to be *ultra vires*, invalid and not binding, and lest the contractor shall have performed and fulfilled the contract in whole or in part, only to find that he is not entitled to recover for his services, labor and materials. These are hardships against which neither the courts nor public officials can relieve, though they may be subsequently authorized and payment provided for by act of the legislature or of Congress, if the contractor have the influence requisite to secure the passage of a bill authorizing the same, which frequently is not only expensive to the contractor in time, but in other valuable considerations.

55. *Restrictions and Limitations are Numerous.*—The restrictions and conditions precedent prevailing in these modern times in the various states and nations are so numerous, so exacting, so extraordinary, that no corporation or well-informed business man or men will undertake a project of any importance without the advice and counsel of a local attorney. To do so is suicidal to the best interests and success of an undertaking. A restriction affecting the right to enforce or to recover under a contract is that existing in some states and which requires that the contract (and in some states the specifications and plans) shall be registered in the office of the town or county clerk, which precludes the contractor from recovery for the work done and the materials furnished if the law be not complied with and which in some localities makes the contractor's recovery secondary to that of material men and laborers who have furnished materials or labor for the structure. These laws may appear to the student drastic and unreasonable and unconstitutional and against the inviolability of contracts and within the inhibitions of the Constitution of the United States, but they have been held constitutional and are in force, and it is much easier and far more economical to meet such conditions than it is to litigate them through the highest courts to establish their unconstitutionality.

56. *Lien and Labor Laws.*—Other local laws which should always have the consideration of the parties who enter into a contract to be performed in a foreign state or nation are the lien and labor laws, which give to certain persons or classes of persons a preference in the payment or establishment of their claims and which determine the hours of labor, and in some instances even the prices to be paid therefor and the manner of payment. These restrictions may greatly enhance the cost of labor and materials and therefore the structure, and seriously affect the contract price. If they are not considered in making the bid and before entering into the contract, then they may be and become the ruin of the contractor and of the project itself.

In addition to the various statute laws, there should also be mentioned the laws of custom and usage which prevail in different localities and which determine the unit-method or manner of measuring or determining quantities, or the manner and method of doing, performing and completing work and the times or methods of payment. These customs and usages are at times far-reaching, especially in determining the measurement of stone, brick and plaster work.

57. *Authority to Contract.*—One of the most difficult and delicate things to determine in negotiating a contract is the authority of the person or party who assumes to act, to make and enter into a contract. If the real party be a corporation, it is a matter of some delicacy to ask the engineer, the general manager or the president for evidences of his authority to make the contract on behalf of the corporation. The authority is vested primarily in the board of directors, and it can be delegated only by an act of the board of directors regularly convened, at a regular or special meeting duly and properly called. Frequently the president or general manager is authorized to execute contracts by the by-laws or by a general resolution of the board. In such cases it is incumbent upon the contractor to ask to see such minutes or to be furnished with a copy of such resolutions certified over the hand of the secretary and the corporate seal of the company. Likewise, the authority of a public officer should be determined before accepting or entering upon a contract executed by him. An agent, likewise, should be expected to show conclusive evidence of his authority, by power of attorney ordinarily, to make and enter into contracts for and on behalf of his employer or principal. The authority of a public officer will usually be found in the constitution or statutory laws of the state or in the charter and ordinances of a municipality. Much trouble, litigation and loss would be prevented if contractors, engineers and architects would look into this matter of authority of the parties to act, before accepting obligations assumed by them.

58. *Legal Representatives of the Parties.*—In contracts that are assignable it is customary to declare the contract binding upon the legal representatives of the parties. This is hardly necessary, as every assignable contract is for the benefit of the legal representatives of the parties. It might be that the legal representatives of a person deceased might refuse to proceed with and fulfill some contracts that partake of the character of personal services, and it is a common practice to describe the parties as being the persons or partnership and their executors, administrators or assigns. A frequent expression among engineers and architects is to seek to obligate an incorporated company, "its executors, administrators and assigns," as if a corporation could have executors and administrators, which is impossible. A corporation's legal representatives are usually described by the words "successors and assigns"; a person's by the words "executors, administrators or assigns," sometimes by the word "*heir*," which in a contract is superfluous.

59. *Consideration.*—The consideration of a contract ordinarily

is that which the contractor is to receive for his undertaking, but what he is to do is no less a consideration moving to the owner. In the contemplation of the law, that which the contractor is to do or perform is the *legal* equivalent of that which he is to receive from the owner, but the law (the court) shuts its eyes to ordinary inequalities and will not substitute its own opinion for that of the parties as to whether or not the acts and deeds of the parties are equivalent. The courts will find an adequate consideration, unless it be so clear that the consideration cannot be equivalent to the obligation assumed by the other party. A ridiculous illustration of such a case is one where the contract provides that "for and in consideration of one dollar by the parties each to the other in hand paid (a mutual exchange), the contractor hereby does undertake and agree as follows." It is perfectly apparent that the exchange of one dollar affords no consideration for the obligation of the contractor, and such an expression might better be entirely omitted, as it is an express declaration that no consideration did pass between the parties.

60. *Execution of Contracts.*—Contracts are usually executed, *i. e.*, evidenced, by the signature and seal of the party and frequently by the acknowledgment of that signature before a notary or commissioner of deeds. The signature and seal subscribed and placed at the end of a contract are to witness the same; the seal is a mere formality quite necessary when either of the parties is a corporation. Care should be taken that the signature is in the name of the party who assumes the obligation and whose name is written at the beginning of the contract as the contracting party. It is especially important that the exact title of a corporation should be used, and the name of the corporation should be subscribed, followed by the word "By" and the name of the officer who executed it, with his title. It is good practice to place at the left thereof the word "Attest," with the seal and the subscription of the name of the officer who attests and affixes the seal. Likewise the *name* of a co-partnership should be signed *in full* with the word "By" and the name of the party subscribing, with his title, as partner, agent or attorney. A person acting under a power of attorney as an *attorney-in-fact* should be distinguished from an *attorney-at-law* merely. A common form is "IN WITNESS WHEREOF the parties hereto, on the day and date above written, have hereunto subscribed their names and affixed their seals." This, however, will not answer for a corporation which has not the power to subscribe its name and to affix its seal. For a cor-

poration a common form is "IN WITNESS WHEREOF the parties hereto have caused this instrument to be executed by its appropriate officers on the day first above written."

61. *Proof of Contract.*—The object of having a contract, deed or bond signed is in order that it may be more readily proven in court. The courts require that either the parties themselves be called to prove the execution of the instrument, or that somebody who saw or knows the signatures of the parties, testify to the fact that they are the signatures of the parties. It is therefore convenient to have the party who witnesses the subscription to the instrument, attest to the same by subscribing to the following words, "Signed, sealed and delivered in the presence of," if the delivery of the instruments be made then and there. If only signed and sealed then omit the word "delivered." It is preferable, however, to have the execution of the instrument acknowledged before a public officer authorized to take such acknowledgments. Such are notaries public, commissioners of deeds, clerks and judges of courts. If such an officer signs and seals such an acknowledgment the court will accept the instrument as sufficiently proved to be admitted in the evidence. If, however, the instrument is to be used in some other state than that in which the notary public or commissioner of deeds resides, it is necessary to have the clerk of the court (the county clerk) of the county in which the notary or commissioner of deeds resides certify that the person so subscribing is a notary public during the period within which the instrument is acknowledged to have been executed. This certificate should not be overlooked upon any instrument which is to be used without the state within which it is executed, especially if the instrument (contract or otherwise) is to be registered with the county or town clerk in said foreign state. If the contract is to be used in a foreign country, it is sometimes necessary to have it attested or certified by the minister or consul credited to that country.

There is more to the proper execution of a contract, deed or bond than is generally supposed among laymen, and it is well always to submit a contract, deed or bond to an attorney before it is finally accepted, for advice as to whether it has been duly and properly executed and all the requirements of the law complied with.

62. In conclusion, the writer would impress upon technical students a realization of the value to them, as engineers or business men, of the study of the principles of contract law, and recommends most strongly an earnest effort to prepare Specifica-

tions and Contracts covering the examples presented by Dr. Waddell, and in connection therewith to study and apply the principles which he has laid down, having in mind the evils and misfortunes described in the foregoing sections. As practicing engineers and architects, or as business men, you will unquestionably appreciate the value of such study and exercises more than you can now, as students, realize their importance. A very valuable feature of Dr. Waddell's lectures is the practical examples presented, which are abundant food for intellectual effort and application. For reference and for a more extended treatment of the law of contracts, the writer naturally refers to his own works, which Dr. Waddell has already mentioned in the text.

It is the element of practical illustration and example—the principle of laboratory instruction embodied in Dr. Waddell's lectures that will recommend his treatment to professors of technical schools. This principle is the one that to-day places the industrial schools nearly a century in advance of the schools of law and perhaps of theology. This presentation and study of the practical and the theoretical together is the one thing, more probably than any other, that has contributed to the superiority of our industrial and technical schools, and our colleges of medicine, dentistry and agriculture. Much though it is to be regretted, it has yet to be adopted generally in the law schools.

Be not content with theories,

Dare the arduous and practical.

“Reading makes a full man, writing an exact man.”

Read and write.

INDEX.

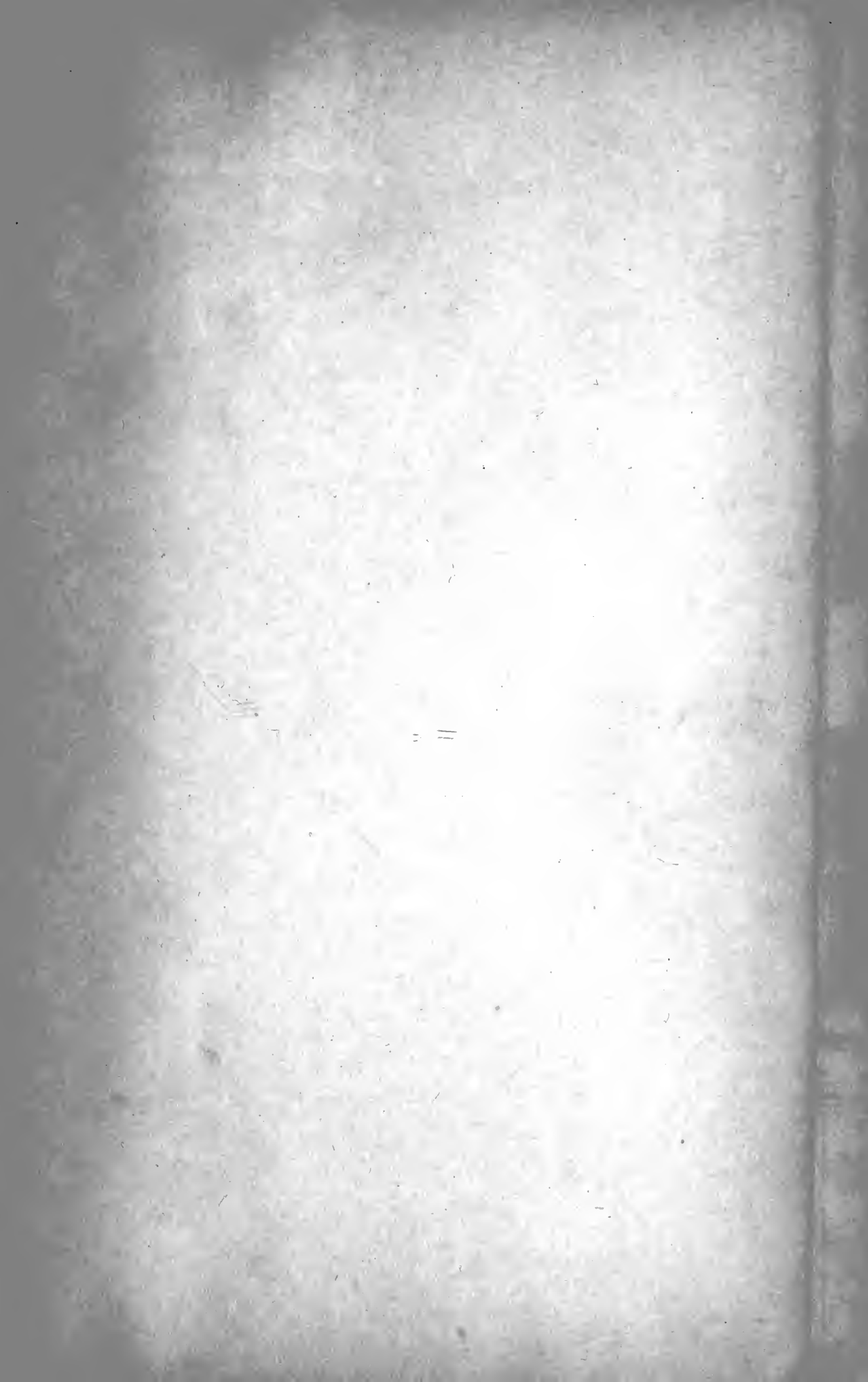
	Page		Page
Abandonment of work....	17, 86, 88	Bridge contract, example of....	80
Abrogation:		Cancellation of contracts....	71, 154
Contingent on engineer's certificate	155	Cement	30
Of contract	71, 154	Fineness of.....	31
Abutments, concrete.....	29	Storage of	32
Acceptance:		Tests	31
By engineer an added safeguard	139	Changes in specifications.....	11
Of defective work.....	14, 141	Co-contractors, specifications in conflict with work of.....	144
Of structure	141	Commissary	83
Accidents, responsibility for....	15	Commercialism	7
Accounts	84	Competency of parties to contracts	65, 67
Adherence to specifications.....	10	Compromise on claims.....	75
Agency	68	Concealment of facts.....	8
Agreement:		Concrete	29
For developing large enterprise	89	Tamping dry surfaces in.....	30
Promoters'	89	Conditions, changes in.....	7
To finance an enterprise.....	99	Conditions precedent to contract.	69
Alterations	7	Conflict between specifications and contractor's judgment..	143
Affecting validity of contract.	153	Conflict of specifications and plans with terms of contract	133
In contracts	72	Conflict of specifications with co-contractor's work.....	144
In specifications.....	11	Consideration	76, 166
Of plans.....	15	Inadequacy of, in contract....	70
To be ordered in writing.....	19	Construction:	
Appeal from arbitrator's award.	73	Of contract as a whole.....	142
Arbitration	160	Of contracts and specifications	146
Appeal from award of.....	73	Of steel pier.....	40
Defeat of.....	161	Contract:	
Of disputes.....	20, 73	Abrogation of.....	154
Arbitrator, single.....	162	Authority of parties to.....	166
Arbitrators	88	Cancellation of.....	154
Assignment forbidden.....	20	Consideration of.....	166
Of moneys earned.....	159	Construction against party using language.....	135
Attestation to contracts.....	65	Construction of.....	146
Authority to contract.....	166	Construed as a whole.....	142
Backfilling	32	Covenants of.....	150
Bending tests	25	Date of	75
Blasting	23	Engineer's powers defined in.	138
Bonds	74, 79, 87		
Borings	28		
For steel pier.....	40		

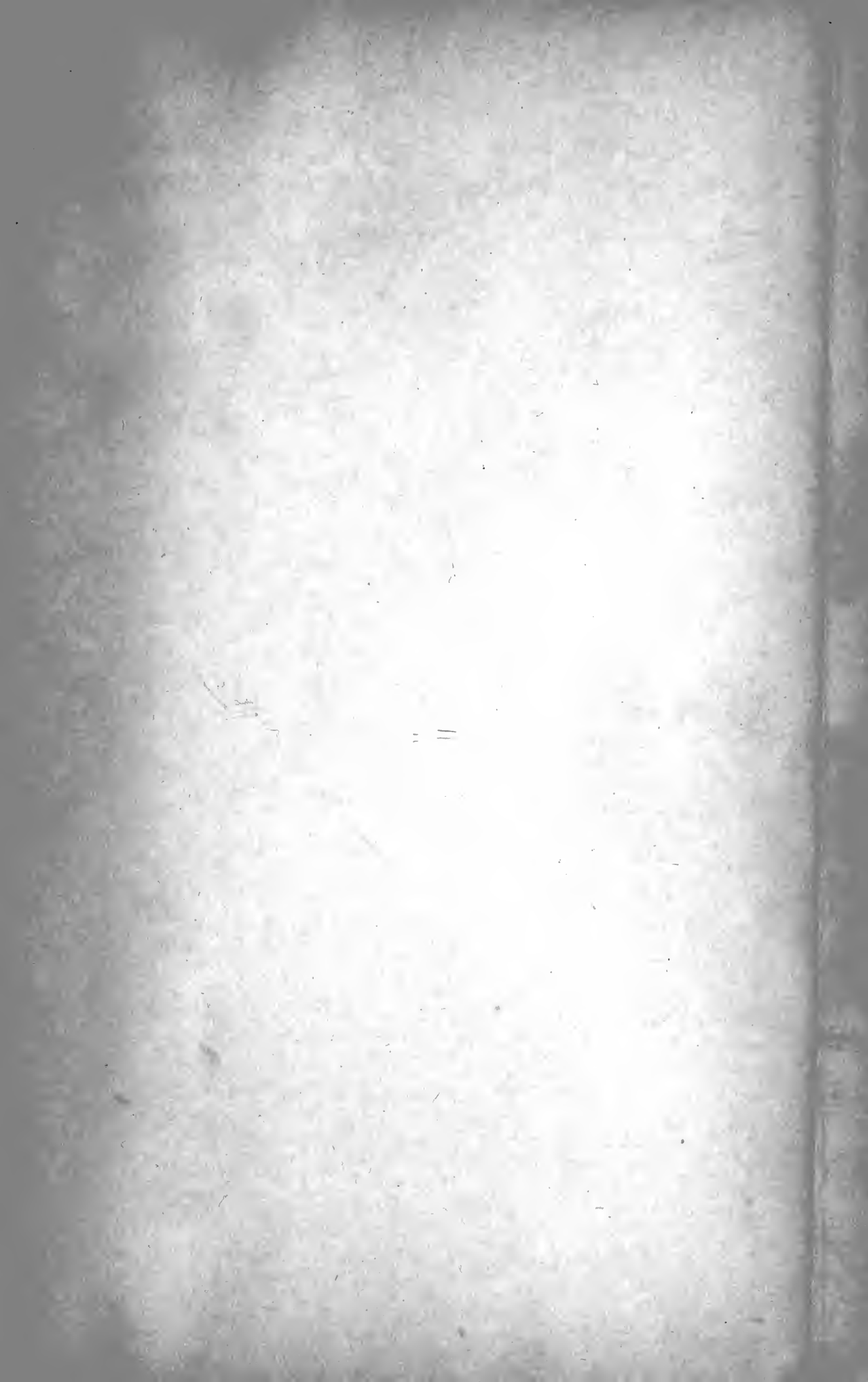
	Page		Page
Essentials of.....	70-76	Drawings:	
Execution of.....	167	At variance with plans.....	133
Form	76	Detail	3, 12
Intention to be fully expressed		Errors in.....	12
in	147	Shop	13
Interpretation of.....	134, 135	Verification of.....	12
Proof of	168	Drifting tests.....	25
Punctuation of.....	135	Duration of contract.....	69
Relative lengths of various		Engineer, status of.....	1
parts	146	Engineering contracts.....	60
Scope of	21, 61, 131	Engineer's acceptance:	
Signature and seal.....	75	An added safeguard.....	139
The superior instrument.....	134	Of defective work and ma-	
Time of essence in	153	terials	141
Unsealed	75	Engineer's decision.....	78, 87, 138
Validity of, affected by altera-		As to extra and additional	
tions	153	work	162
Waiver of clauses in.....	155	Vs. arbitration	160
Warranty involved in entirety	137	Engineer's details.....	12
Witnesses to.....	75, 168	Engineer's duty to follow speci-	
Written and printed matter..	135	fications	139
Contract writing, examples for		Engineer's mistakes	9
practice in.....	110-127	Engineer's powers defined in con-	
Contractor, directions to.....	14	tract	138
Contractor's details	12	Engineer's preparation	7
Contractor's judgment in conflict		Engineer's rejection of work and	
with specifications.....	143	materials	140
Contractors, several.....	6	Equity	74
Contracts:		Erasures in legal documents....	107
All parts reconciled if possible	134	Essentials of contracts.....	63
Distinguished from specifica-		Attestation	65
tions	60	Introduction	64
Engineering	60	Parties, authority of.....	66
Essentials of.....	62, 63, 70-76	Parties, description of.....	65
For personal service.....	69	Parties, number of.....	65
Fraudulent changes of.....	108	Parties, precedence of.....	66
Indemnity clauses in.....	158	Ultra vires.....	66
Misplaced confidence in.....	62	Eventualities	70
Corporations:		Example:	
Power of, to do business.....	163	Promoter's agreement.....	89
Restrictions imposed on...164, 165		Examples for practice in contract	
Corrections of legal documents..	107	writing	110
Cost-plus-a-percentage plan.80, 89, 149		Bond	126
Counsel	108	Concrete dam, promoter's agree-	
Covenants of contract.....	159	ment	116
Damages	15	Copartnership	126-127
Liquidated	32, 71, 89	Electric St. Ry. and viaduct... 110	
Date of contract.....	75	Employment, agreement for... 116	
Decision of engineer.....	78	Engineering partnership 114	
Defective work.....	86	Engineering services, contract	
Acceptance of.....	14	for	123
And materials accepted by en-		Guaranty of syndicate by	
gineer	141	bankers	125
Delay, no damages for.....	20	Ocean pier.....	120
Delays	78, 79, 83	Partnership, engineering..... 114	
Deliberation	108	Replacing steel Ry. bridge.... 113	
Delivered material	19	Syndicate, contract among	
Development of large enterprise,		members	123
agreement for	89		

	Page		Page
Viaduct	112	Character of	152
Water-supply and sewage system	119	Defined	5
Examples for practice in writing specifications	48	Extras	18
Abutments and piers	51	Price of	77
Archbridge, reinforced concrete	53	To be ordered in writing	72, 78, 79
Arch culvert	49	Favoritism	6
Bridge erection	58	Field riveting	26
Bridge, R. R.52, 53,	59	Financing an enterprise, agreement for	99
Building, steel	57	Forms for concrete work	30
Chimney, brick	55	Foundations:	
Cleaning and repainting	55	Depths of	28
Concrete sewer main	53	Lighthouse	35
Dam, concrete	54	Fracture	25
Dyke	56	Fraudulent changes of contracts	108
Excavation	56	Government as party to contract	68
Foundation, floating	58	Guaranty of results	3
Grading	50	Implied understanding of plans	137
Jetties, rock	55	Implied warranty of work	136
Lighthouse, steel	58	Indemnity	15, 78
Paving:		Clauses in contracts	158
Asphalt	56	For negligence	75
Wood block	56	Indulgences, effect of	156
Piers:		Infants	67
Masonry	52	Inspection:	
Timber	54	Delay in	13
Pipe line	51	Expense of	13
Railroad	54	Facilities for	13
Bridge	52, 53,	Field	13
Reinforced-concrete arch bridge	53	Final	14
Retaining wall	49	Notice of	13
Roundhouse	58	Of defective work	14
Sea-buoy	58	Strictness of	16
Settling basins	56	Insurance	85
Sewer main, concrete	53	Intent of specifications	16
Steel water tank	53	Intention, to be fully expressed	147
Swingbridge	57	Interpretation of contract,	
Timber pier	54	134, 135, 148	
Tower, steel	59	Introduction to contract	64
Track, electric Ry.	57	Labor laws	165
Train-shed	57	Legal advice	108
Trestle, R. R.	54	Legal representatives of parties to contract	69, 166
Tunnel, in clay	50	Letting work among several contractors, disadvantages of	148
Rock	50	Levels	27
Turntable	55	Lex loci	71, 162
Viaduct	59	Lien laws	165
Water tank, steel	53	Liens, discharge of	16
Well, brick	55	Lighthouse	34
Examples of specifications:		Description	34
Lighthouse	34	Dwelling house	37
Pipe line	45	Foundations	35
Steel pier	39	Pile driving	35
Excavation	29	Spiral stairs	36
Execution of contracts	68, 167		
Form of	79, 88		
Executive	68		
Extension of time	19		
Extra compensation	20		
Extra work	151		
Application of specifications to	145		

	Page		Page
Substructure	35	Piles for steel pier.....	40, 41
Woodwork	38	Piling	29
Limits of the work to be defined	133	Pipe line, specifications for....	45
Lines and levels.....	27	Plans:	
Liquidated damages.....	32	Alteration of.....	15
In contracts	71, 89	At variance with drawings....	133
Litigation, notification of.....	21	Conflict of with contract.....	133
Loading metal work on vessel..	44	Prepared by contractor.....	3
Locality, advantage of.....	5	Understanding of.....	137
Market, advantage of.....	5	Utility of	2
Married women.....	67	Plant, definition of.....	82
Materials:		Powers of engineer defined.....	138
Acceptance of defective.....	141	Preambles of contracts.....	68, 70
Approximate quantities.....	22	Precision	8
Care of delivered.....	19	Prices:	
Cement	30	Schedules of.....	77
Concrete	29	Unit	34
Delivery of.....	85	Prior negotiations	8
Hauling of.....	22, 27	Professional service, contracts	
Metals	23	for	72
Old and new	21	Progress of work.....	86
Rejected by engineer.....	140	Progress payments	16
Removal of.....	21	Promoter's agreement	89
Rewrought	24	Proof of contract.....	168
Shipping	27	Proposals	33
Title to.....	77	Protection of pipes.....	46
Workmanship on.....	25	Pumping from excavations.....	29
Medical attendance.....	83	Punching of steel work.....	25, 26
Membership organization.....	66	Punctuation of contract.....	135
Mistakes of engineer.....	9	Reaming punched holes in steel	
Negligence	78	work	26
Indemnity for.....	75	Rejection of work and materials	
Notification of impending suits.	21	by engineer	140
Obstructions or obstacles, unfore-		Release of sureties.....	157
seen	28	Repairs	82
Painting:		Replacement of destroyed ma-	
Protection of pipes by.....	46	terial	85
Steel pier.....	42	Responsibility for errors in draw-	
Paints for steel pier.....	43	ings	12
Papers, return of.....	18	Restrictions imposed on corpora-	
Parties to contracts.....	65, 66, 67	tions, legislative.....	164, 165
Incompetent	67	Result to be specified.....	148
Legal representatives of.....	166	Results, when wanted.....	5
Payments on contracts.....	72	Retained percentage of payment	87
For work.....	16	Right of way.....	86
Monthly estimates.....	17	Risks	28
Percentage retained.....	17	Riveting, field.....	26
Progress	16	Scope of contract.....	21, 61, 131
Pay-rolls.	85	Shipping:	
Penalties in contracts.....	32, 71	Materials	27
Personal service, contracts for..	69	Metal work on vessel.....	43
Piers:		Shop drawings.....	13
Concrete	29	Signature of contract.....	75
Specifications for steel.....	39	Acknowledgment of	76
Pile driving, lighthouse.....	35		
Pile foundations	29		

	Page		Page
Single arbitrator.....	162	Thoroughfares, closing.....	15
Specialists	4	Time:	
Specifications:		Extension of	19
Adherence to	10	Of essence in contracts....	76, 153
Against engineer's decision..	138	Titles	10
Alterations in.....	11	Tools and supplies.....	84
And plans, provision in for re-		Traffic, interference with.....	23
sult or complete structure.	148	Transportation:	
Application of to extra work.	145	Of men and materials.....	22, 27
Changes in, effect of.....	11	Of metal work by vessel.....	44
Conclusive	4	Travel, expenses for.....	83
Conflict between contractor's		Ultra vires	66
judgment and.....	143	Understanding of plans.....	137
Conflict of with co-contractor's		Undertaking	76, 77
work	144	Unsealed contract (specialty)..	75
Conflict of with contract.....	133	Validity of contract as affected	
Construction of	146	by alterations	153
Contents of	132	Variance: plans vs. drawings..	133
Definition of	2	Verification of drawings.....	12
Engineer's duty to follow....	139	Vouchers	84
General and special provisions	9	Waiver	77
Good	4	Of contract clauses.....	155
Intent or spirit of.....	16	War, effect on contracts.....	67
Language of	6	Warranty of work.....	137
Of results	3	Implied	136
Preparation of	2	Witnesses to contract.....	75, 168
Purpose of	3	Woodwork for dwelling house..	38
Scope of	61	Work:	
To be created	132	Abandonment of.....	17
What are the?	132	Acceptance of defective.....	141
Work in accordance with.....	136, 144	According to specifications....	136
Ultimate object	9	And material rejected by en-	
Specific clauses	21	gineer	140
Steel and iron.....	23, 24	At cost-plus-a-percentage or	
Structure, acceptance of.....	141	fixed sum	149
Subletting of work.....	78, 86, 159	Completion by owner.....	17
Forbidden in contracts.....	20, 73	Implied warranty of.....	136
Sunday laws	108	Limits to be defined.....	133
Surety	18	Payments for	16
Release of	74, 157	Subletting of	159
Tamping concrete	30	To satisfaction of owner.....	144
Temporary works	22	Workmanship	25
Tenders	33	Written vs. printed parts of con-	
Testing materials:		tract	135
Cement	31		
Steel and iron.....	24, 25		





DEC 24 1907



LIBRARY OF CONGRESS



0 028 160 823 A